Exhibit 5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD. AND DELL INC.,
Petitioner,

v.

SOLAS OLED, LTD.,
Patent Owner.

Patent No. 6,072,450

DECLARATION OF ADAM FONTECCHIO, PH.D.

I, Adam Fontecchio, Ph.D., declare as follows:

1. I have been retained as a technical consultant by Samsung Display Co., Ltd., who I have been informed is one of the petitioners in the present proceeding, as well as on behalf of Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., who I have been informed are identified as "real parties in interest" in the present proceeding. For ease of reference, throughout my declaration, I will refer to these entities collectively as "Samsung." I am also informed that Dell Inc. is a co-petitioner in the present proceeding. Again, for ease of reference, throughout my declaration, I will refer to Samsung Display Co., Ltd. and Dell Inc. together as "Petitioner."

2. I have been asked by counsel for the Petitioner to consider whether the references listed as Exhibits 1001-1006 and 1009–1011 below disclose or suggest, alone or in combination, the limitations recited in the claims of U.S. Patent 6,072,450 (the "'450 patent"). I have also been asked to consider the state of the art and the prior art available before the filing of the '450 patent. I have provided my opinions below.

3. I have been informed that a company known as Solas OLED Ltd. alleges to be the owner of the '450 patent. To the best of my knowledge, I have no financial interest in Samsung, Dell, Solas OLED Ltd., or the '450 patent. To the best of my recollection, I have had no contact with Solas OLED Ltd. or the named

inventors of the patent, Hiroyasu Yamada, Tomoyuki Shirasaki, and Yoshihiro Kawamura. To the extent any mutual funds or other investments that I own have a financial interest in Samsung, the Patent Owner, or the '450 patent, I am not aware of, nor do I have control over, any financial interest that would affect or bias my judgment.

4. I am being compensated at my standard consulting rate for my time, and my compensation is in no way contingent on the results of these or any other proceedings relating to the above-captioned patent.

I. BACKGROUND AND QUALIFICATIONS

5. I am a professor of electrical engineering specializing in electro-optics and displays. I have studied and researched the function and use of numerous types of display technologies, including TFT-LCD, Holographically-formed Polymer Dispersed Liquid Crystal (H-PDLC) displays, Electrophoretic Displays (EPD), nano-Field Emission Displays (nFED), and novel electroluminescent displays including organic light emitting materials. I have conducted extensive research on color filtering, reflective and transmissive displays, and the fundamental interactions of light and matter. I have published numerous articles and delivered many lectures and research talks on these subjects.

6. I have been employed as a faculty member at Drexel University since 2002. Currently, my rank is that of tenured Full Professor. I served as the Vice-

Dean of the Graduate College at Drexel University from 2015–2017, and from 2013-2015 served as an Associate Dean of the College of Engineering at Drexel University. Prior to my current position, I was a graduate student at Brown University, working under the direction of Prof. Gregory Crawford, where I conducted doctoral research on new technologies to be used in displays. While studying at Brown University, I completed a Bachelor's degree in Physics in 1996, a Master's degree in Physics in 1998, and a Doctorate degree in Physics in 2002.

7. During my career as a doctoral student, researcher, and faculty member at Drexel University, I have conducted and directed research that is related, and of interest, to the display community. I have presented my research and findings at professional organizations and conferences including the Society for Information Display, the Optical Society of America, the American Physical Society, the Materials Research Society, and the International Liquid Crystal Society.

8. My research into electro-optic phenomena and devices, as well as my work in engineering education initiatives, has been sponsored by both government agencies and private industry. My government sponsors have included the National Science Foundation, NASA, the Department of Energy, the National Institute of Standards and Technology (NIST), the US Army CERDEC, the Pennsylvania Department of Health, and the Department of Education.

9. I am a Senior Member of the IEEE, have served as Vice-Chair of the IEEE Philadelphia Branch, and am a member of the American Society for Engineering Education (ASEE).

10. I have worked as a consultant on technical issues, including electro-optics and displays, for private clients primarily offering technical guidance, contracted research services, or expert testimony. In the course of my work as a faculty member and as a consultant, I have visited microfabrication and display fabrication facilities around the world and witnessed the fabrication process first-hand.

11. While a doctoral student at Brown University, I studied the morphology and structure of liquid crystal based devices. Nanoscale microscopy and imaging was a significant part of my thesis work, and I have significant experience with scanning electron microscopy ("SEM"), atomic force microscopy ("AFM"), and surface structure profilometry. For my final two years of graduate school, I served as the in-house expert on SEM, performing the majority of SEM imaging and analysis for the entire research group.

12. At Drexel University, my research has included microfabrication and associated characterization methods, including SEM analysis. I spent several years rebuilding a class 1000 cleanroom with a class 100 wet lab clean room included, which became the shared Micro Fabrication Facility ("MFF"). I also served as

Director of Micro/Nano Fabrication, A. J. Drexel Nanotechnology Institute, Drexel University, where I oversaw the acquisition, installation, and operation of microfabrication instrumentation for over 100 users/researchers.

13. In summary, I have extensive familiarity with fields involving displays. Based on my experience, as well as my review of the literature, I am familiar with what the state of this field was at the relevant time up to the time that the '450 patent was filed.

14. In addition to my education and work experience that I have outlined above, a complete list of my work experience, awards, honors, and publications that may be relevant to the opinions are set forth in my CV (Exhibit 1008).

II. MATERIALS CONSIDERED

15. I am not an attorney and I am not offering any legal opinions as part of this declaration. However, through my consulting work I have had experience studying and analyzing patents and patent claims from the perspective of a person of ordinary skill in the art.

16. I have reviewed the '450 patent—both the claims and specification, as well as the associated prosecution history. In addition, I have reviewed a number of prior art references. I have provided below a complete list of materials considered in rendering the opinions found in this declaration.

Exhibit	Description
1001	U.S. Patent No. 6,072,450 (the "'450 patent")
1002	File History for U.S. Patent No. 6,072,450
1003	U.S. Patent No. 5,670,792 ("Utsugi")
1004	JPH053079 (certified translation, "Manabe")
1005	WO 96/25020 (certified translation, "Eida")
1006	S.W. Amos, Principles of Transistor Circuits, 8th Ed. (1994)
1009	JPH053079 ("Manabe")
1010	WO 96/25020 ("Eida")
1011	U.S. Patent No. 5,847,516 ("Kishita")

III. RELEVANT LEGAL STANDARDS

17. As I noted earlier, I am not an attorney and do not provide any legal opinions as part of this declaration. However, for the purposes of this declaration, I have been informed about certain aspects of the law by the attorneys for Petitioner that are relevant to forming my opinions. Below is a summary of the law that has been explained and provided to me.

a. Anticipation

18. Petitioner's counsel has informed me that a patent claim may be "anticipated" if each element of that claim is present either explicitly or inherently in a single prior art reference, and that the elements should be arranged in the reference as in the claim. Petitioner's counsel has informed me that for a claimed

limitation to be inherently present, the prior art need not expressly disclose the limitation, so long as the claimed limitation necessarily flows from a disclosure in the prior art.

b. Obviousness

19. Petitioner's counsel has informed me that even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a person of ordinary skill in the art at the time the application was filed.

20. Petitioner's counsel has informed me that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

a) the level of ordinary skill in the art at the time the application was filed;

b) the scope and content of the prior art; and

c) what differences, if any, existed between the claimed invention and the prior art.

21. Petitioner's counsel has informed me that a single reference can render a patent claim obvious by itself if any differences between that reference and the claims would have been obvious to a person of ordinary skill in the art. Alternatively, the teachings of two or more references may be combined in the same

way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider, among other factors:

a) whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results;

b) whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent;

c) whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

d) whether a person of ordinary skill would have recognized a reason to combine known elements in the manner described in the claim;

e) whether a person of ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so; and

f) whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art.

22. Petitioner's counsel has informed me that one of ordinary skill in the art has ordinary creativity and is not an automaton. Petitioner's counsel has

informed me that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

23. Petitioner's counsel has informed me that under specific circumstances whereby a secondary reference is not being used to teach a limitation but rather to explain the teachings of a primary reference, a specific motivation to combine need not be identified; however, in the case of the combination of art discussed in this declaration, a specific motivation to combine is present and I have identified it.

24. Petitioner's counsel has also informed me that, in this proceeding, the claim terms should be given their plain and ordinary meaning as understood by one of ordinary skill in the art, consistent with the disclosure and the prosecution history.

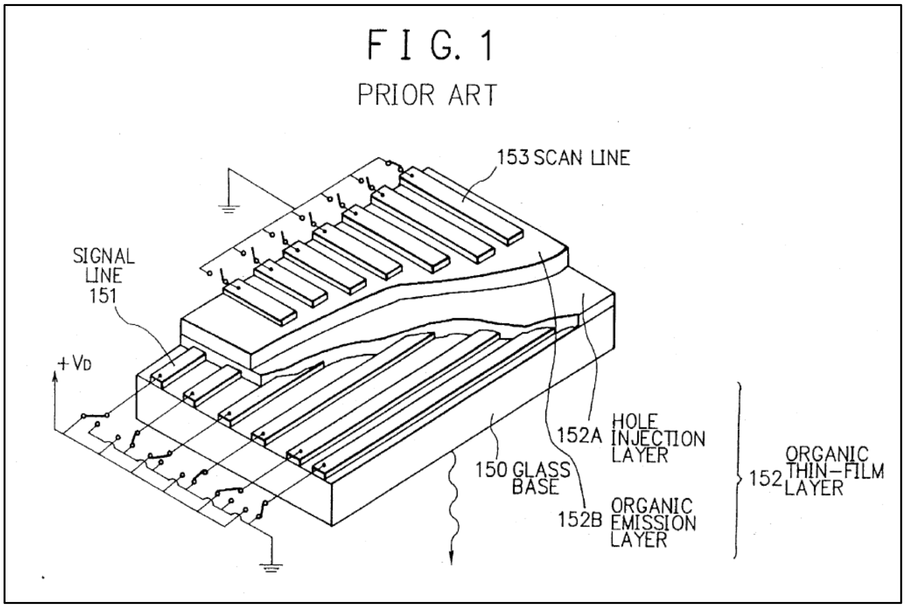
IV. BACKGROUND OF MATRIX DISPLAYS

25. According to the face of the patent, the '450 patent was filed on November 21, 1997, but claims priority to two Japanese references filed on November 28, 1996. Ex. 1001 at cover. Accordingly, for purposes of my discussion below, I assume that the timeframe of the purported invention of the '450 patent was November 1996, and have provided an overview of the background of matrix displays by this timeframe. In particular, I have provided a brief discussion of passive and active matrix displays, as they relate to the '450 patent.

a. Passive Matrix Displays

26. Passive matrix addressing is a convenient method of addressing a large array of pixels when using a top to bottom electrode system. This particular method works through orthogonal rows and columns of individually electrically controlled electrodes located on the top and bottom of the switchable sample. By activating a row on the top and a column on the bottom, only in the intersection of the row and column is there a large enough electric field to completely activate the pixel.

27. Figure 1 of Utsugi, reproduced below, shows the basic configuration of a passive matrix display. As shown in the figure, conductors form rows and columns for the top and bottom electrodes, depicted here as scan line 153 and signal line 151. An organic emission layer, like the organic emission layer 152B, can be formed between the electrodes. Applying a voltage bias to a row and column will cause a voltage difference great enough to activate the pixel at the intersection of the activated row and column, e.g., for the pixel to turn on and emit light.



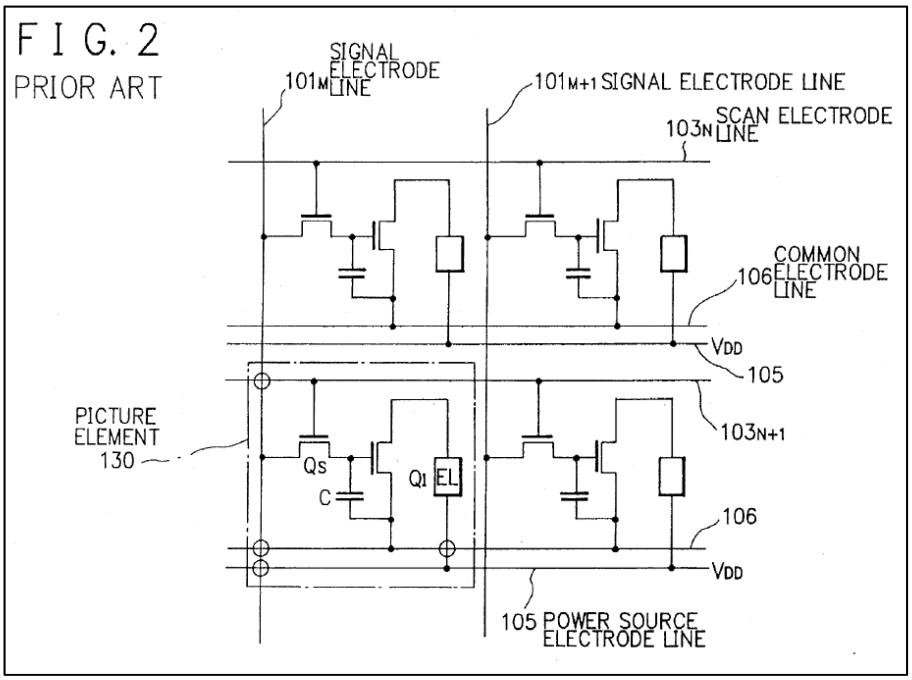
28. Historically, the passive matrix system was employed primarily for large arrays where running a trace to each pixel is space prohibitive. Passive addressing has some significant limitations, such as the inability to create a ring structure, or a structure with a cutout in the center. In addition, as discussed by the '450 patent, in order to ensure that each pixel holds its image for the entire frame, i.e., for the time it takes to address every scan line, high voltages are often necessary to create an adequate electric field. *See, e.g.,* Ex. 1001 at 1:30–37.

b. Active Matrix Displays

29. Active matrix addressing was designed in an effort to overcome the issues encountered in multiplexing devices like passive matrix displays, by way of adding individual modulation of each pixel using a pixel-by-pixel switch. The dominant technology used in active matrix addressing is thin film transistor ("TFT")

technology. Originally demonstrated as a potential driving element in 1966 by RCA, transistors act as individual on-off switches at each pixel.

30. In an active matrix display, each individual pixel contains at least one thin film transistor and a storage capacitor. Rows and columns of the display are then used to control the transistors, which in turn modulate the current across the organic emission layer. The basic configuration of a TFT array for an active matrix display is demonstrated, for instance, in Figure 2 of Utsugi, shown below.



31. The process of generating a dynamic image via active matrix addressing requires a few sequential steps. First, the gate voltage of a transistor, for example, the switching transistor Q_S in Figure 1, is applied on the scan line. Ex. 1003 at 3:4–5. The capacitor is then charged based on the parameter of the data line, e.g., the signal electrode line 101_M, which feeds into the source of the transistor. Ex.

1003 at 3:5–7. This turns on the current-controlling transistor Q_I and allows current to flow across the electroluminescent element of the pixel. Ex. 1003 at 3:7–10.

32. In the second step, the switching transistor's gate voltage sets the transistor to turn off. Once this occurs, the next scan line is activated. When the switching transistor is turned off, the time constant of the capacitor holds the intensity of the pixel at a relatively constant value while the remaining scan lines are scanned, generating a complete frame. Ex. 1003 at 3:7–10.

33. Finally, this entire process is repeated, with the state of each pixel being redefined by the next image. This scanning process continues to repeat, creating a moving and dynamic display through the continual actuation of all the pixels.

34. Row and column drivers are generally attached to the edges of the TFT array glass substrate to supply the address and data signals to the pixels. The row and column drivers receive their signals from one or more controller circuits mounted on a printed circuit board.

35. Given the superior picture quality, speed, and driving voltages, active matrix technology is the primary driving method in use today for displays. Since the late 1990s and early 2000s, it has taken over from passive matrix displays, and it is unusual to find passive matrix drive methods in any significant display technology today.

36. Active matrix technology has been used with multiple types of flat panel displays, including liquid crystal displays (LCDs), as well as the organic electroluminescent displays described in the ’450 patent and the prior art. In organic electroluminescent displays, which make use of organic light emitting diodes (OLEDs), a voltage is applied to one or more layers of organic semiconductor material(s), which will emit light of various wavelengths, based on the composition of the layer(s). Active matrix OLED display technology is commonly referred to as AMOLED.

V. OVERVIEW OF U.S. PATENT 6,072,450

a. Summary

37. According to the cover of the patent, the ’450 patent is entitled “Display Apparatus,” and it was filed on November 21, 1997. Ex. 1001 at cover. In the “Field of the Invention” section of the patent, the ’450 patent states that the “[p]resent invention relates to a display apparatus, and more particularly to an electroluminescent (hereinafter referred to as EL) display apparatus with a matrix display panel including EL elements.” Ex. 1001 at 1:5–8. As I have explained above, by the November 28, 1996 foreign filing date, matrix display panels including electroluminescent elements were well-known. Ex. 1001 at 1:11–14.

38. The ’450 patent acknowledges that matrix display panels were known prior to the filing date, but claims to solve two particular problems with conventional

matrix displays, i.e., to provide a display which (1) "has a light emitting area enlarged so as to emit light at a satisfactorily high luminescence even though a voltage applied to an EL layer is low, and which has long luminance life," and (2) "prevents light from entering active elements such as transistors, to thereby avoid the malfunction of the active elements." Ex. 1001 at 2:66–3:7.

39. By way of background on these issues, the '450 patent describes the passive matrix technology used in earlier electroluminescent displays. In passive matrix EL displays, a matrix is formed through a grid of perpendicular cathode lines (serving as common lines) and anode lines (serving as data lines), and an organic EL layer is situated between the two. Ex. 1001 at 1:14–21. "A positive voltage is applied to the data lines in each of cathode selection periods, thereby driving organic EL elements located at the intersections of the common lines and the data lines." Ex. 1001 at 1:21–24. "The display apparatus displays an image which corresponds to the voltage applied to the data lines." Ex. 1001 at 1:24–25.

40. In such displays, displaying an entire frame consists of cycling through each cathode line, selecting one line at a time. The period over which the EL element will continue to emit light after the cathode selection period is short; accordingly, conventional passive matrix displays increased the luminance of the organic EL layer of each pixel by applying a higher voltage to the organic EL layer during the

selection period. Ex. 1001 at 1:30–39. However, raising the voltage across the EL layer can lead to its deterioration. Ex. 1001 at 1:40–41.

41. Active matrix displays address this particular problem by including a pair of transistors, "which confer a voltage storing capability on the pixels." Ex. 1001 at 1:47–51. As shown in Figure 22 of the '450 patent below, which discloses "related art," Ex. 1001 at 5:12–13, each pair of transistors consists of a selection transistor T1 and drive transistor T2, Ex. 1001 at 1:51–52. The selection transistor T1 is connected to the data line DL, and the gate of the selection transistor T1 is connected to the address or gate line GL. Ex. 1001 at 1:52–55. The gate electrode of the drive transistor T2 is connected to the selection transistor T1. Ex. 1001 at 1:55–56. The source of the drive transistor T2 is connected to a constant voltage line VL, and the drain of the drive transistor T2 is connected to the anode electrode 103 of the EL device. Ex. 1001 at 1:56–65.

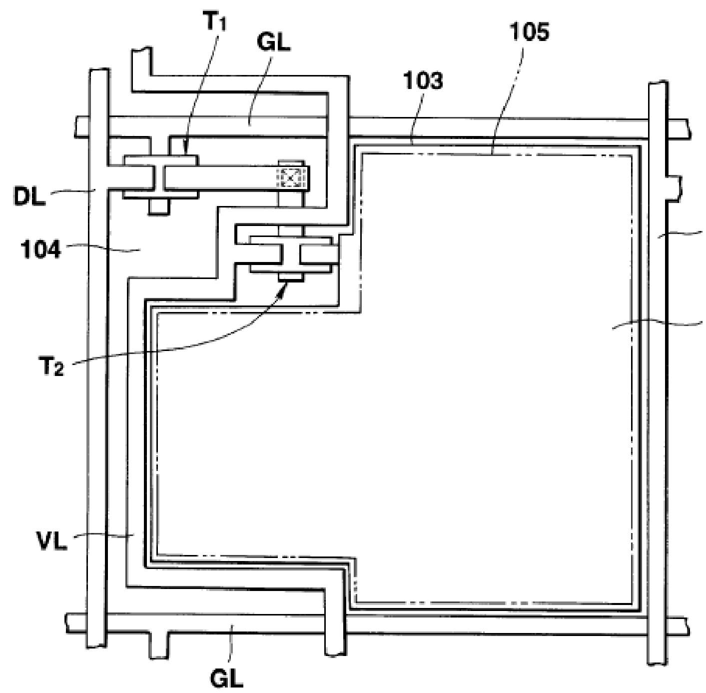


FIG.22

42. When the selection transistor T1 is turned on by the gate line GL, image data is passed through T1 to the drive transistor T2, turning T2 on and off. When T2 is on, a current flows from the constant voltage line VL through T2, a first electrode (the anode electrode 103), an organic EL layer 106, and a second electrode (the cathode electrode 107), causing the EL layer to emit light. *See* Ex. 1001 at 2:2–6. I will refer to the first electrode, the organic EL layer, and the second electrode as the "EL structure."

43. As the '450 patent explains, the transistors used in the active matrix can be sensitive to light. When light enters the channel of the transistors, it can cause "unnecessary photoelectromotive force," which causes the transistors to

malfunction. Ex. 1001 at 2:27–32. Accordingly, in bottom-emitting devices, there is a concern with locating the TFTs under the electroluminescent device, as light from the electroluminescent layer could then enter the TFTs.

44. As shown in Figure 22 above, and as explained by the ’450 patent, conventionally, this problem was addressed by limiting the light emitting area of each pixel “to an area in which the thin film transistors T1 and T2 are not located.” Ex. 1001 at 2:32–37. By avoiding the region of the pixel where the transistors are located, the overall light emitting area of the pixel is decreased.

45. The ’450 patent solves these issues through the use of a particular structure, wherein the TFTs of each pixel are covered by all three elements of the organic EL structure, including the first electrode (cathode), the organic electroluminescent layer, and the second electrode (anode). This structure can be seen in Figure 2 of the ’450 patent below.

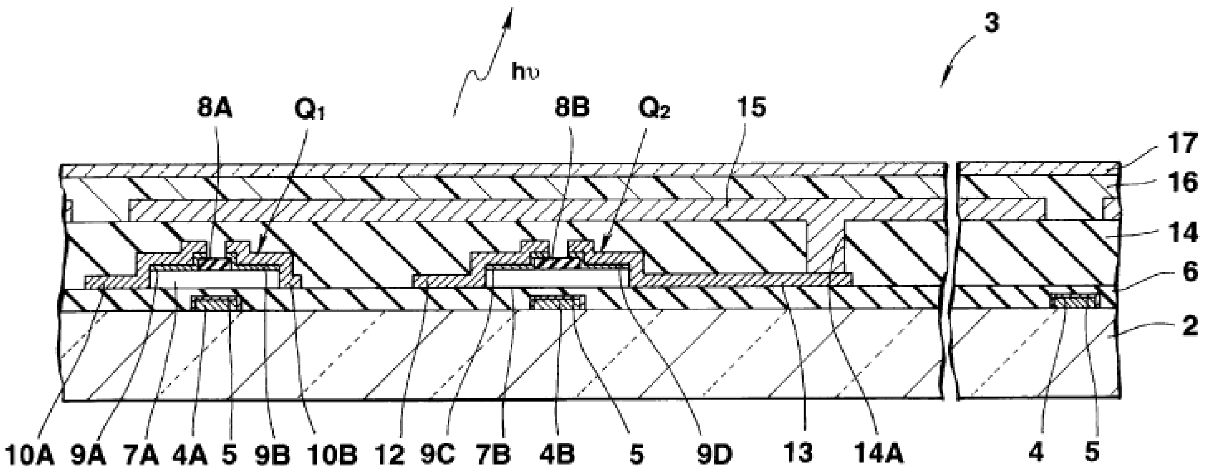


FIG.2

46. As shown in Figure 2, the selection transistor Q1 and the drive transistor Q2 are formed on the substrate 2. The organic EL structure is formed above the TFTs, such that the first electrode (cathode electrode 15), the organic EL layer 16, and the second electrode (anode 17) cover the TFTs. The first electrode (cathode 15) is made of a light-blocking material that prevents light from entering the TFTs and reflects light back out of the top of the device.

47. Because the TFTs are shielded from the light emitted from the organic EL layer 16, the EL structure can be formed over nearly the entirety of the pixel area, as shown in Figure 1 of the ’450 patent below.

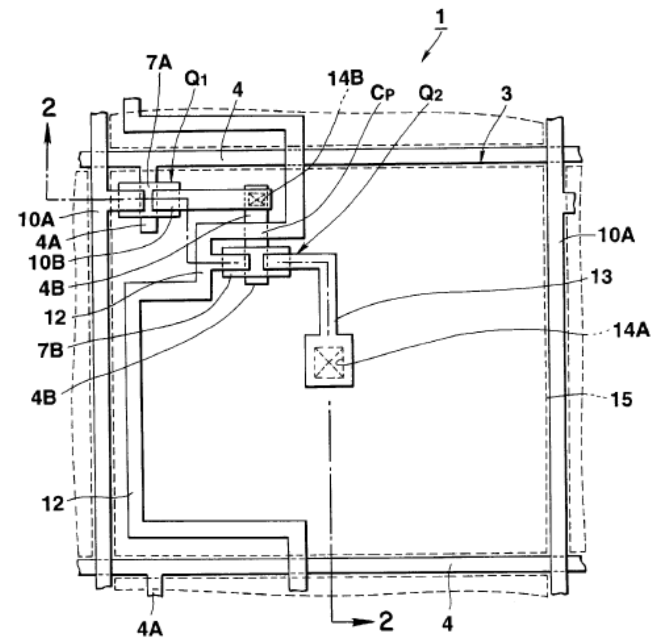


FIG.1

48. In addition to the structure described above, the ’450 patent also includes embodiments that make use of wavelength conversion layers and/or color filters. These layers allow for a multicolor display. An example of such a structure is shown in Figure 12 below. The wavelength conversion layers, such as layers 52R, 52G, and 52B absorb light emitted from the organic EL layer 16 and emit light in a different wavelength (e.g., absorb blue light and emit red and green light). Ex. 1001, 11:47–65. As their name implies, the color filters, such as 55R, 55G, and 55B filter the light, permitting only certain wavelengths to pass, which results in a higher color purity. Ex. 1001, 12:49–13:17.

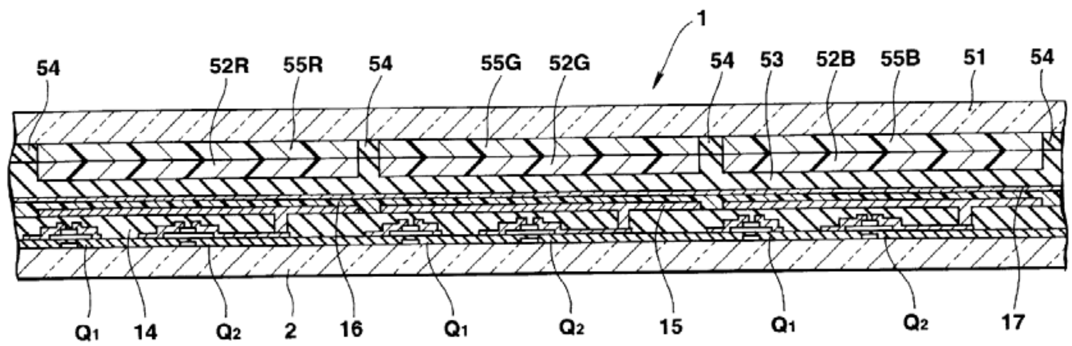


FIG.12

b. File History

49. As part of the preparation of my declaration, I have reviewed the file history for U.S. Application No. 08/976,217, the application that led to the '450 patent. The original independent claims of the application were rejected by the Examiner as either anticipated or rendered obvious by the prior art. Ex. 1002 at 154–162 (August 31, 1999 Non-Final Rejection).

50. In response to the Examiner's rejections, the applicants amended independent claim 1 and former independent claim 16 (issued claim 15) to include, among other things, limitations that the electroluminescent layer be formed of an organic electroluminescent material, and to require that the organic electroluminescent material and second electrode cover the active elements. Ex. 1002 at 294–307 (November 30, 1999 Amendment). In their "Remarks," the applicants generally differentiated the prior art based on any of the following: (1) the prior art comprised an electroluminescent layer that was not organic, Ex. 1002

at 304 (November 30, 1999 Amendment); (2) the prior art did not include the claimed arrangement of the first electrode, organic electroluminescent layer, and the second electrode all covering the active elements, Ex. 1002 at 305; or (3) that the prior art did not disclose the specific layer formation order for preventing thermal deterioration, i.e., forming the organic EL layer after forming the transistors, so as not to expose the organic EL layer to high temperatures, Ex. 1002 at 305.

51. In response to the applicant's arguments, the Examiner allowed the claims.

c. The Claims at Issue

52. For purposes of this declaration, I have been asked to address claims 1–9, 11–13, and 15–18. For reference, I have provided the language of each of those claims below:

> 1. A display apparatus comprising: a substrate; active elements formed over said substrate and driven by an externally supplied signal; an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole; at least one first electrode formed on said insulation film so as to cover said active elements, and connected to said active elements through said at least one contact hole, said at least one first electrode being made of a material which shields visible light; an organic

electroluminescent layer having an organic electroluminescent material formed on said at least one first electrode so as to cover said active elements and including at least one layer which emits light in accordance with a voltage applied to said at least one layer; and at least one second electrode formed on said organic electroluminescent layer which covers said active elements.

2. The display apparatus according to claim 1, wherein said at least one first electrode is formed of a conductive material containing magnesium.

3. The display apparatus according to claim 1, wherein said at least one first electrode has a rough surface which is in contact with said organic electroluminescent layer.

4. The display apparatus according to claim 1, wherein said active elements are a selection transistor which is turned on in response to an externally supplied address signal and a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer, said selection transistor and said drive transistor forming a pair.

5. The display apparatus according to claim 4, wherein said at least one first electrode is connected to said drive transistor through said at least one contact hole.

6. The display apparatus according to claim 4, wherein: said display apparatus further comprises a capacitor for retaining the signal corresponding to the image data externally supplied through said selection transistor while said selection transistor is on; and while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor.

7. The display apparatus according to claim 1, wherein: said active elements are transistors forming pairs and arranged in a matrix pattern, one transistor of each of said pairs being a selection transistor which is turned on in response to an externally supplied address signal, and the other transistor of each of said pairs being a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer; said selection transistor of each of said pairs is connected to one of address lines and one of data lines, said address lines being formed over said substrate and

being supplied with said address signal, and one of said data lines being formed over said substrate and being supplied with said image data; and said at least one first electrode is plural in number, and the plurality of first electrodes are arranged in a matrix pattern in areas surrounded by said address lines and said data lines.

8. The display apparatus according to claim 1, wherein a constant voltage is applied to said second electrode.

9. The display apparatus according to claim 1, further comprising at least one wavelength conversion layer formed over said at least one second electrode, said at least one wavelength conversion layer emitting light in a first wavelength range by absorbing light in a second wavelength range emitted from said organic electroluminescent layer.

11. The display apparatus according to claim 9, wherein said at least one wavelength conversion layer has at least two of a red conversion layer which emits light in a red wavelength range, a green conversion layer which emits light in a green wavelength range, and a blue conversion layer which emits blue light.

12. The display apparatus according to claim 1, wherein: said display apparatus further comprises at least one filter formed above

said at least one second electrode; and light lays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

13. The display apparatus according to claim 12, wherein said at least one filter has a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength range pass through, and a blue filter which makes light in a blue wavelength range pass through.

15. A display apparatus comprising: a substrate; selection transistors formed over said substrate and arranged in a matrix pattern; drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors; address lines connected to said selection transistors and through which a signal for turning on said selection transistors is supplied; data lines connected to said selection transistors, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on; an insulation film formed over said substrate so as to cover said drive

transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors; first electrodes made of a material which shields visible light, and formed on said insulation film so as to cover said selection transistors and said drive transistors, said first electrodes being arranged in a matrix pattern in areas surrounded by said address lines and said data lines, and being connected to said drive transistors through said contact holes; an organic electroluminescent layer formed on said first electrodes which covers said selection transistors and said drive transistors and including at least one layer which emits light in accordance with an applied voltage; a second electrode formed on said organic electroluminescent layer which covers said selection transistors and said drive transistors; a first driver circuit for selectively supplying said address signal to said address lines in sequence; and a second driver circuit for supplying said image data to said data lines.

16. The display apparatus according to claim 15, wherein a constant voltage is applied to said second electrode.

17. The display apparatus according to claim 1, wherein said display apparatus further comprises at least one filter, formed above

said at least one second electrode, which selectively permits light rays in a first wavelength range to pass therethrough when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

18. The display apparatus according to claim 17, wherein said at least one filter has a red filter which permits light in a red wavelength range to pass therethrough, a green filter which permits light in a green wavelength range to pass therethrough, and a blue filter which permits light in a blue wavelength range to pass therethrough.

VI. LEVEL OF ORDINARY SKILL IN THE ART

53. It is my understanding based on my discussion with the attorneys for the Petitioner that factors defining the level of ordinary skill in the art include: (1) the types of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of technology; and (5) the educational level of active workers in the field.

54. Applying these factors, it is my opinion that a person of ordinary skill in the art ("POSA") at the time of the alleged invention of the '450 patent (which, as discussed above, is November 28, 1996 (Ex. 1001 at cover)) would have had a relevant technical degree in Electrical Engineering, Computer Engineering,

Materials Science, Physics, or the like, and experience in active matrix display design and electroluminescence.

VII. CLAIM CONSTRUCTION

55. As discussed above, is my understanding that in this proceeding, the claim terms should be given their plain and ordinary meaning as understood by a POSA, consistent with the disclosure and the prosecution history.

56. After reviewing the ’450 patent and the prosecution history, I do not believe that any constructions are necessary other than the plain and ordinary meaning of the claim terms as would be understood by a POSA.

57. However, I have been asked to briefly explain how a POSA would understand the term “active elements,” as used by the ’450 patent. In my field, “active elements” generally are understood to means elements that supply energy to a circuit, for instance, by controlling the flow of current. Based on my review of the patent, it does not appear that the ’450 patent provides a unique definition for the term. However, the ’450 patent does indicate, in a number of instances, and I agree, that one component that would constitute an active element is a transistor.

58. For instance, in the “Summary of Invention” section, the ’450 patent specifies that the “[i]t is another object of the present invention to provide a display apparatus which prevents light from entering active element such as transistors.” Ex. 1001 at 3:4–7. Similarly, claim 4 expressly states that the active elements can

include a selection transistor and a drive transistor, and claim 7 notes that "said active elements are transistors."

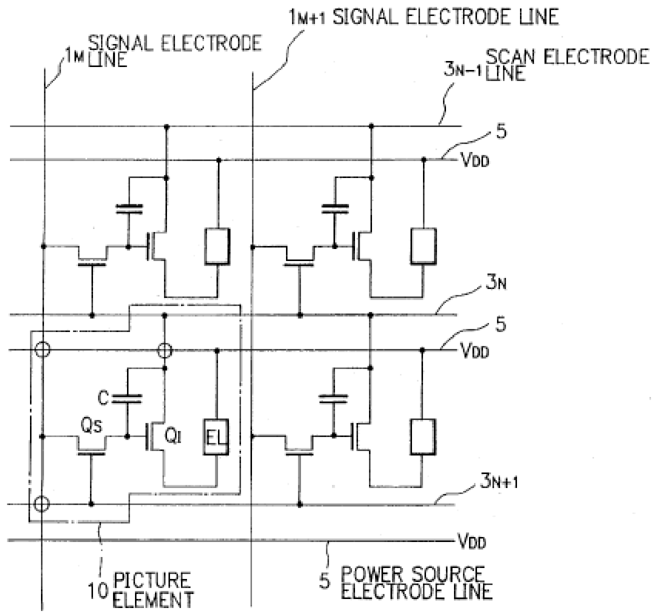
VIII. OVERVIEW OF THE PRIOR ART

a. Utsugi (U.S. Patent No. 5,670,792)

59. Utsugi describes a "current-controlled luminous element array and a method for producing the same, and in particular . . . a current-controlled luminous element array of an active matrix type such as for a display purpose, having multiple current-controlled luminous elements arranged in a matrix form." Ex. 1003 at 1:7–13.

60. As shown in Figure 3 below, Utsugi describes a specific active matrix structure, wherein each pixel comprises two TFTs, including a current-controlling transistor Q_I and a switching transistor Q_S, a capacitor C, and a layered organic thin-film EL element. Ex. 1003 at 5:57–6:23.

FIG. 3



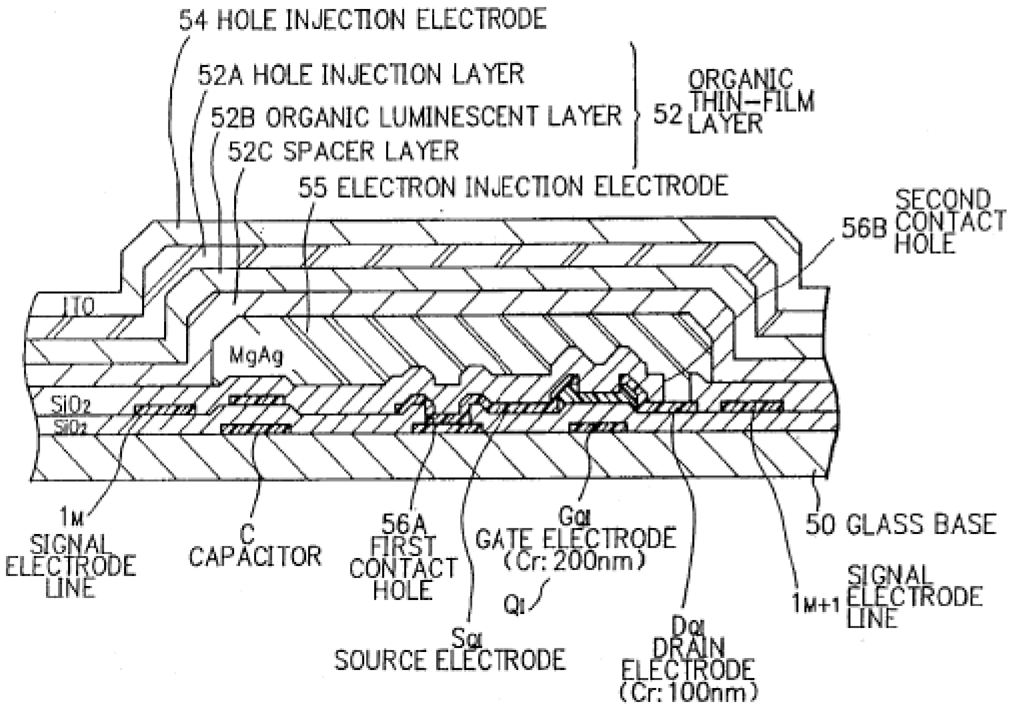
61. Similar to the circuit in the ’450 patent, as is evident from Figure 3, the purpose of the switching transistor Q_S is to pass a signal (e.g., image data) from the signal electrode line 1_M to the gate of the current-controlling transistor Q_I, effectively turning current-controlling transistor Q_I on and off. *See, e.g.*, Ex. 1003 at 2:49–58. In turn, the current-controlling transistor Q_I regulates the current through an organic electroluminescent element EL. *See, e.g.,* Ex. 1003 at 2:49–58. When the EL element is on, light is output from the pixel. The capacitor C helps hold the voltage on the gate of the current-controlling transistor Q_I as the display cycles through various address lines, i.e., scan electrode lines 3_N.

62. Utsugi describes a particular device structure, similar to the structure claimed in the ’450 patent, which is illustrated in Figures 4 and 5 of Utsugi. Figure

4 is a plan view of the device, Ex. 1003 at 5:39–40, while Figure 5 is a cross-section of a portion of the device shown in Figure 4, Ex. 1003 at 5:41.

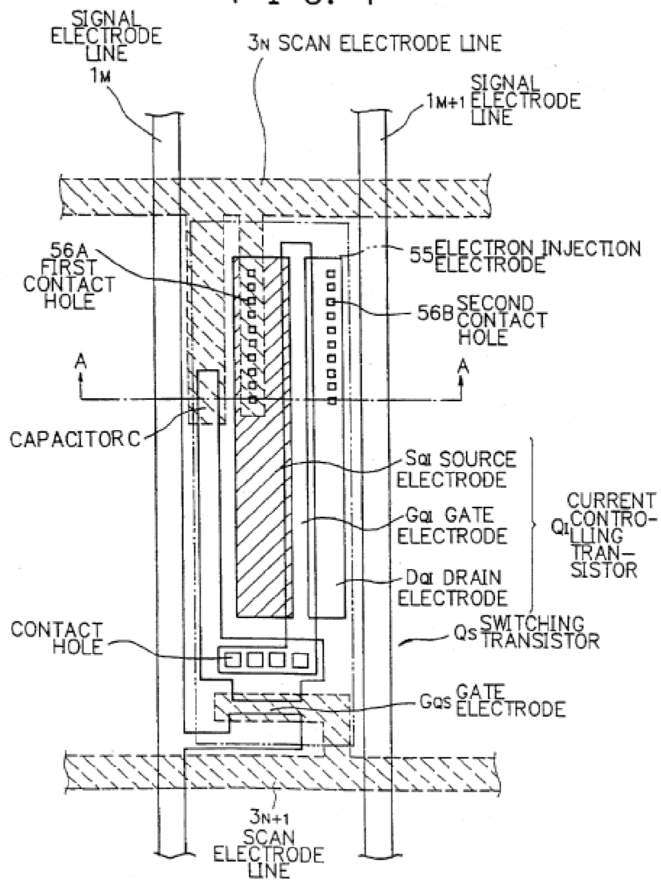
63. As shown in Figure 5 below, the display in Utsugi includes a number of different layers. Starting from the bottom, Utsugi describes a glass base 50 (i.e., a substrate); a first metal layer comprising the lower electrode of the capacitor C, a gate electrode for the current-controlling transistor Q_I and the switching transistor Q_S (not shown), and the scan electrode line 3_N (not shown); a first insulating layer made of SiO_2; a second metal layer comprising the upper electrode of the capacitor C, the source and drain electrodes of the current-controlling transistor Q_I and the switching transistor Q_S (not shown), and signal electrode line 1_M; a second insulating layer made of SiO_2; an electron injection electrode 55 made of MgAg; an organic thin-film layer 52, comprising a spacer layer 52C, an organic luminescent layer 52B, and a hole injection layer 52A; and a hole injection electrode 54. Ex. 1003 at 7:20–8:10.

FIG. 5



64. As shown in Figure 5 above, the electron injection electrode 55, organic thin-film layer 52, and the hole injection electrode are formed so as to cover the current-controlling transistor Q_I. Utsugi makes clear that these elements further cover the switching transistor Q_S. Ex. 1003 at 6:23–29, 6:53–59. As shown in Figure 4 below, "the electron injection electrode 55 is patterned like an independent i[s]land in each picture element region," covering both transistors. Ex. 1003 at 6:53–59.

F I G. 4

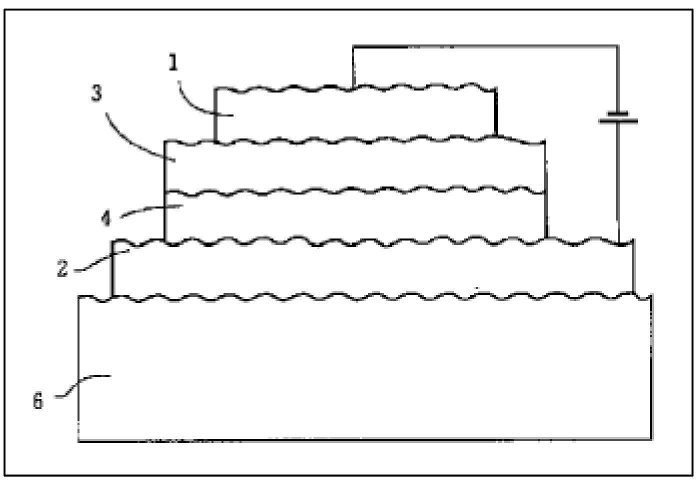


65. Unlike the injection electrode 55, which is patterned for each pixel, Utsugi explains that "the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., [they are] formed over the entire region of a display panel," which would also include both transistors. Ex. 1003 at 6:50–59. In fact, Utsugi states that the luminescent element EL, which would include the electron injection electrode 55, the organic thin-film layer 52, and the hole injection electrode 54, "extends over the

capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003 at 6:23–28.

b. Manabe (Ex. 1004)

66. Manabe is a Japanese patent publication directed to solving viewing angle problems in organic electroluminescent displays. Ex. 1004 at ¶ 31. As shown in Figure 1 of Manabe below, Manabe discloses a structure comprising layers with roughened surfaces that help to prevent disuniformity of luminance based on viewing angle. Ex. 1004 at ¶ 31 ("Therefore, interference effect is averaged, and changes in visual angle dependence in luminance and the light emitting spectrum and variation in membrane thickness are suppressed.").



67. In particular, Manabe highlights the importance of creating a roughened surface between the light emitting layer 3 and the metal electrode 1. *See* Ex. 1004 at ¶ 24 ("Therefore, roughening of the surface of the organic EL layer in contact with the metal electrode or the surface of the metal electrode in contact with

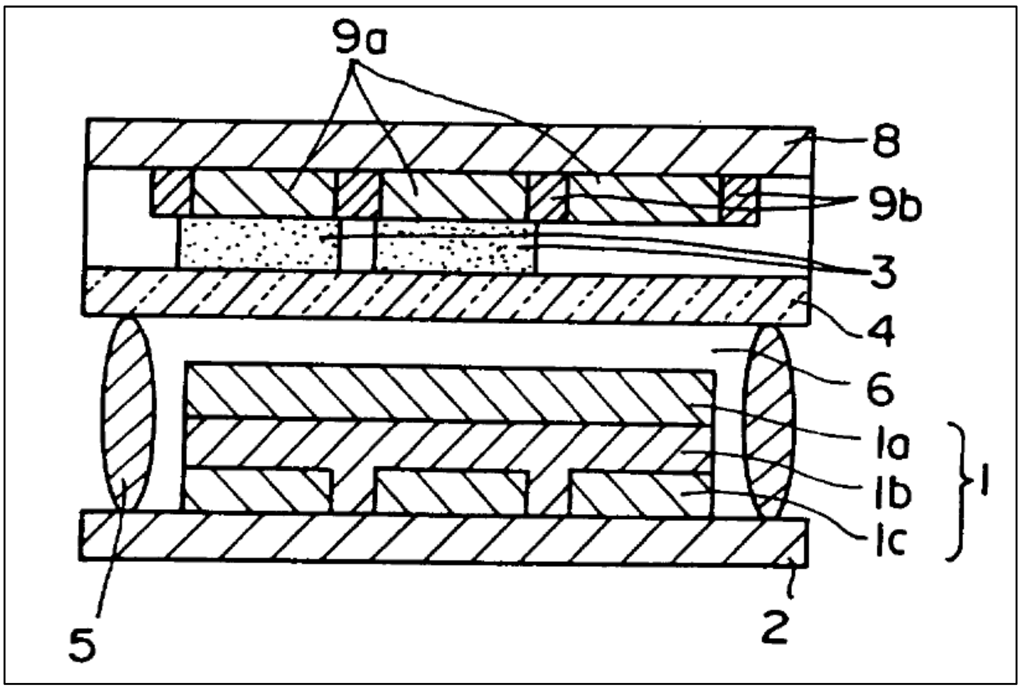
the organic EL layer causes slight differences in the light path from light sources within the light emission layer causing averaging of the interference effect and reducing angle dependence and film thickness dependence.")

c. Eida (WO 96/25020)

68. Eida describes "a multi-color light emission apparatus and a method for producing thereof." Ex. 1005 at Title. The U.S. counterpart to Eida, U.S. Patent No. 5,909,081 was cited during prosecution as part of a rejection of what are now issued claims 9, 11, 12, and 13 (original claims 10 and 12–14). Ex. 1002 at 159 (August 31, 1999 Non-Final Rejection). The Examiner found that Eida teaches both (i) that "a fluorescent layer may convert the light emitted from an organic EL device into light of a wave length longer than that of the light emitted from the organic EL device" and (ii) that "a color filter may be arranged on each of the fluorescent layers to control the fluorescent colors and thereby to promote the color purity." Ex. 1002 at 159 (August 31, 1999 Non-Final Rejection). Notably, at the time of the rejection, issued claims 17 and 18 were not present in the application.

69. Eida describes three "inventions." The first two inventions are directed to multi-color light emission apparatus. Ex. 1005 at 5:7–7:15. The third invention is directed to a process for manufacturing the apparatus disclosed in the second invention. Ex. 1005 at 37:11–12. Figure 5, shown below, illustrates an embodiment of Eida's "first invention." Like Utsugi, the first invention includes an organic EL

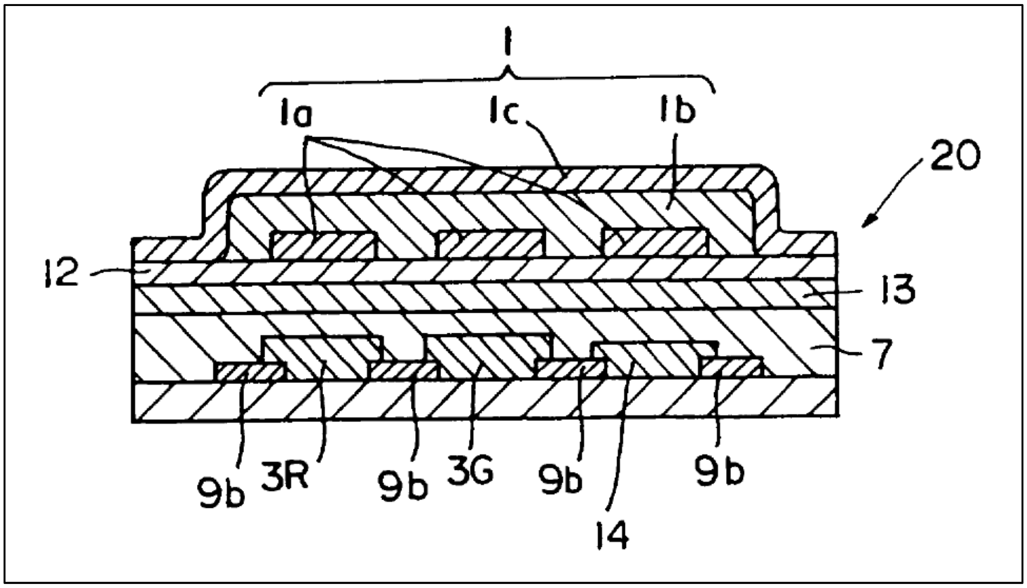
element 1 comprised of an electrode 1c, an organic compound layer 1b, and a transparent electrode 1a. Ex. 1005 at 9:28–10:5. However, the "first invention" further comprises fluorescent layers 3, "which emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)," as well as color filters 9a, which "may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:11–16.



70. As explained by Eida, while the organic compound layer can emit a number of different wavelengths of light ranging from near ultraviolet light to green light, a "blue-green" color is most preferable. Ex. 1005 at 10:26–28. As would be understood by a POSA, the above invention would achieve a multi-color display by converting the blue light emitted from the organic EL element 1 to form both red

and green, using the two separate fluorescent layers 3. Eida explicitly provides a number of different materials that can be used for this type of color conversion. Ex. 1005 at 30:17–32. The red and green light emitted by the fluorescent layers 3 would be filtered by the respective color filters 9(a), for increased color purity. Ex. 1005 at 10:15–16. Meanwhile, blue light from the organic EL element would be filtered by the third color filter 9(a), shown as the rightmost color filter in Figure 5 above. Accordingly, the display is able to emit all three primary colors.

71. Figure 13 of Eida, shown below, illustrates the "second invention" of Eida. Like the first invention, Eida's second invention also uses a combination of fluorescent layers and color filters to create a multi-color display. Figure 13 explicitly labels the red and green fluorescent layers as 3R and 3G respectively. Ex. 1005 at 38:4–8. Eida notes that the "[m]aterials used for the fluorescent layer [in the second invention] can be the same materials as those used in the first invention." Ex. 1005 at 40:25–26.



72. While Figure 13 only depicts a single filter, blue color filter 14, Eida teaches that "a red color filter and a green color filter may be arranged between the red color conversion fluorescent layer 3R and the transparent substrate, and between the green color conversion fluorescent layer 3G and the transparent substrate respectively, thereby adjusting colors of light of a red color and of a green color to improve purity of these colors." Ex. 1005 at 38:4–8.

IX. DISCLOSURE OF CLAIMS 1–2, 4–8, AND 15–16 BY UTSUGI

a. Claim 1

1 [preamble]: A display apparatus comprising:

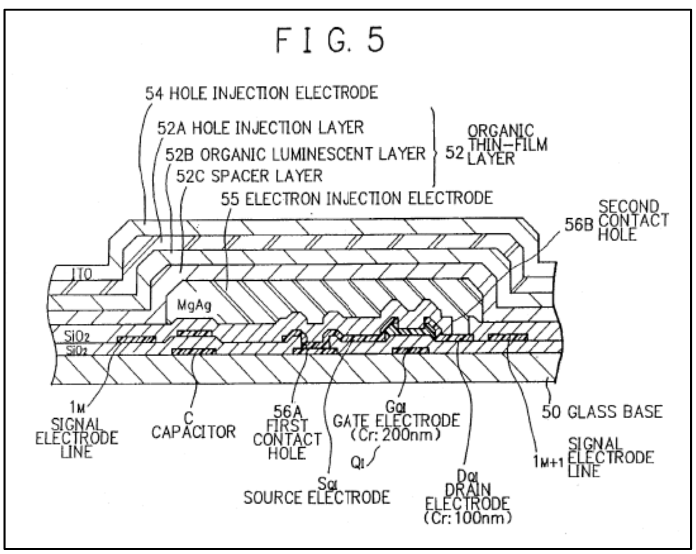
73. Utsugi discloses a display apparatus—specifically, in the "Background Of The Invention" section, Utsugi states that "[t]he present invention relates to a current-controlled luminous element array and a method for producing the same, and

in particular to a current-controlled luminous element array of an active matrix type such as for a display purpose." Ex. 1003 at 1:6-9.

74. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

1[a]: a substrate;

75. Utsugi discloses a substrate, i.e., "glass base 50," shown in Figure 5 below. Utsugi states that "[t]he EL element includes an organic thin-film layer 52 of a three-layered structure having a spacer layer 52C, an organic luminescent layer 52[B] and a hole injection layer 52A laminated in this order over a glass base 50." Ex. 1003 at 6:37–50.



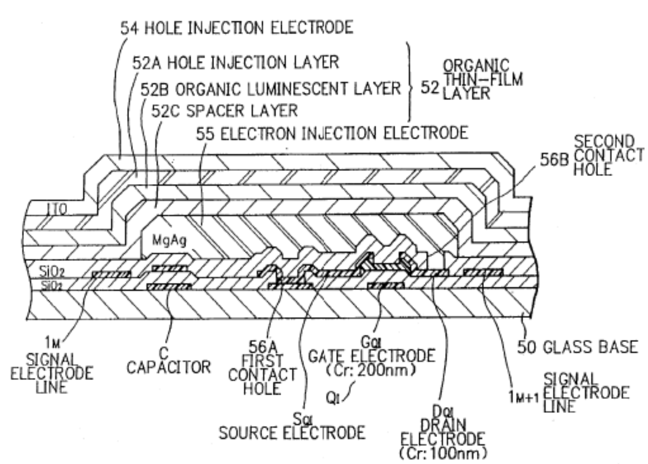
76. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

1[b]: active elements formed over said substrate and driven by an externally supplied signal;

77. Utsugi discloses active elements formed over the substrate and driven by an externally supplied signal. The '450 patent notes that "[i]t is another object of the present invention to provide a display apparatus which prevents light from entering active elements such as transistors, to thereby avoid the malfunction of the active elements." Ex. 1001 at 3:4–7. Utsugi discloses pairs of active elements, i.e, "current-controlling transistor Q_I" and "switching transistor Q_S," which are used to drive each individual pixel. Ex. 1003 at 6:19–23.

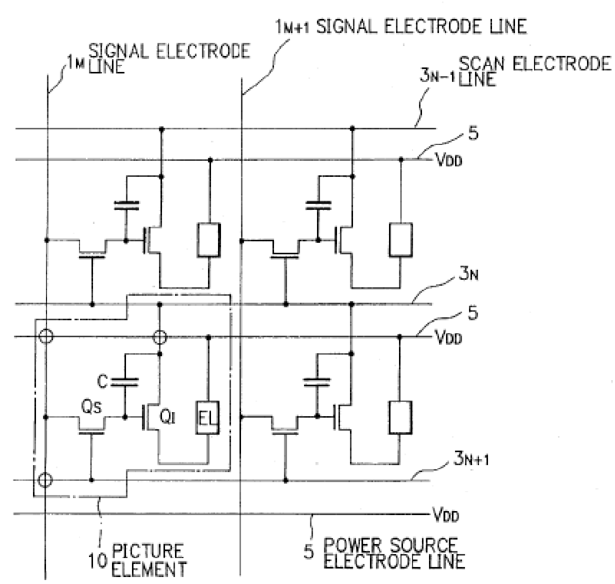
78. As shown in Figure 5 below, Utsugi discloses that the current-controlling transistor Q_I is formed on top of the glass base 50, i.e., is formed over the substrate. Utsugi explains that switching transistor Q_S is similarly formed. Ex. 1003 at 7:20–45 (describing the steps of forming both transistors Q_I and Q_S over the substrate).

FIG. 5



79. The circuit structure for Utsugi is shown in Figure 3 below. As shown in the bottom leftmost pixel illustrated in Figure 3, the switching transistor Q_S is connected between the signal electrode line 1_M on one end, and the capacitor C and gate of the current-controlling transistor Q_I on the other end. "[I]f the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. Consequently, [t]he signal electrode line 1_M in the M-th column then has a line voltage thereof imposed via the switching transistor Q_S on the charge holding capacitor C." Ex. 1003 at 8:13–16. Thus, the switching transistor is driven by the external signal from the scan electrode line, while the drive transistor is driven from the external signal from the signal electrode line.

FIG. 3



80. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

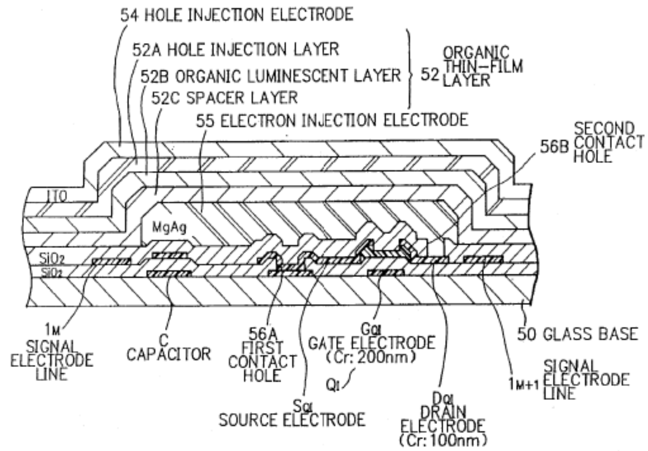
1[c]: an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;

81. Utsugi discloses an insulation film formed over the substrate, which covers the active elements, and which has at least one contact hole. Utsugi describes the steps used to manufacture the device of the first embodiment at 7:16–8:10.

82. First, Utsugi explains that both the switching transistor Q_S and current-controlling transistor Q_I are first formed on the glass base 50. Ex. 1003 at 7:25–45. After the transistors are formed, "a SiO_2 layer is let grow 200 nm." Ex. 1003 at 7:47–52. A POSA would understand that SiO_2 is a commonly used insulating material, and that the SiO_2 layer in Utsugi serves as an insulation film between the metal layer containing, for instance, the source and drain electrodes of the thin film transistors, and the electron injection electrode 55.

83. Second, as shown in Figure 5 below, Utsugi teaches that an etching process is used to "open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55 to be formed as a lower electrode of the organic thin-film EL element." Ex. 1003 at 7:46-51.

FIG. 5



84. Third, a POSA would have appreciated that the SiO_2 insulation layer would cover both transistors. As demonstrated by Utsugi, in semiconductor manufacturing, layers of materials are generally applied or grown sequentially, starting with the substrate. The layers can be deposited on select areas of the substrate, using, for instance, a mask, or the layers can be applied across the entire substrate, and portions can subsequently be removed using processes such as etching. Utsugi describes the latter technique, i.e., the SiO_2 layer appears to be deposited across the entire substrate. It is then subsequently etched to form the second contact hole 56B. Ex. 1003 at 7:46-51. Given that Utsugi describes etching the second contact hole 56B, but not does not describe any further patterning, a POSA would expect that the insulation film would cover the remainder of the substrate, including selection transistor Q_S. Indeed, it would be important for the insulation layer to cover the source and drain electrodes of the selection transistor

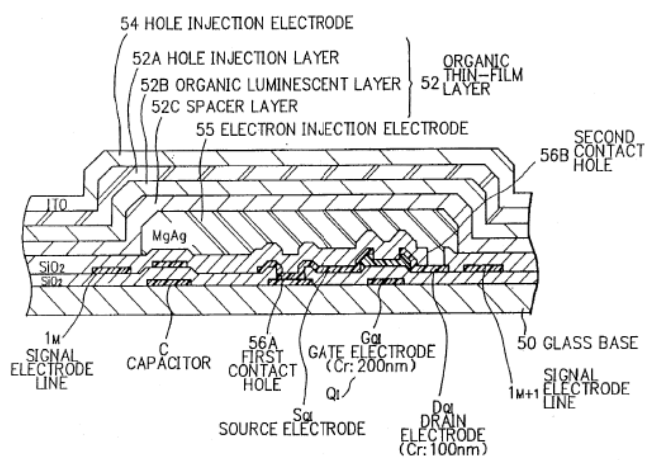
Q_S to keep them from making contact with the metal layer above, used for the electron injection electrode 55, and shorting the two metal layers.

85. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

1[d]: at least one first electrode formed on said insulation film so as to cover said active elements, and connected to said active elements through said at least one contact hole, said at least one first electrode being made of a material which shields visible light;

86. Utsugi discloses limitation 1[d]. First, Utsugi discloses a first electrode formed on the SiO_2 insulation film I discussed above. As shown in Figure 5 below, Utsugi teaches that the electron injection electrode 55 is formed directly on the SiO_2 layer. *See also* Ex. 1003 at 7:47–57 ("[A] SiO_2 layer is let grown 200 nm . . .[t]hen, an MgAg layer is let to grow 200 nm . . . .").

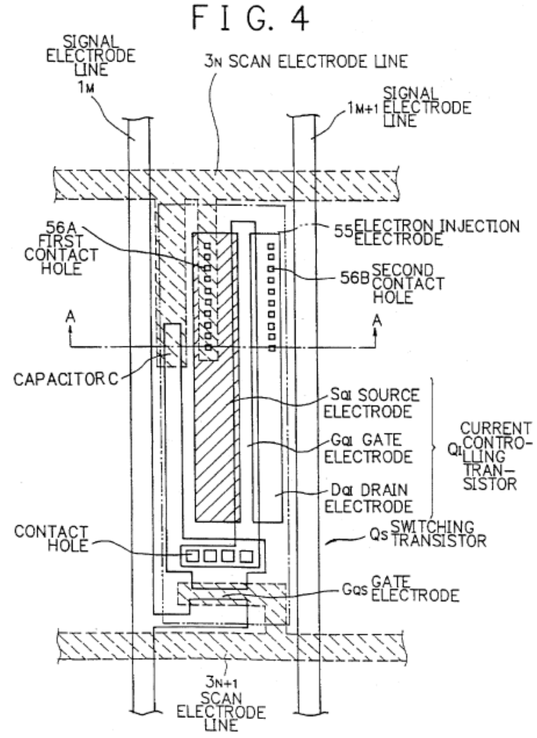
FIG. 5



87. As shown in Figure 5 above, Utsugi teaches that the electron injection electrode 55 is formed such that it covers the current-controlling transistor Q_I. As

shown in Figure 4 below, the electron injection electrode 55 covers the switching transistor Q_S as well. As explained by Utsugi, the entire "luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region," but only the electron injection electrode 55 is shown in Figure 4, "to avoid a complicated drawing." Ex. 1003 at 6:23–29.

FIG. 4



88. Second, Utsugi teaches that the injection electrode 55 is connected to the active elements, i.e., to the current-controlling transistor Q_I through a second contact hole 56B. Specifically, Utsugi discloses that after the SiO_2 layer is deposited, it is etched "to open the second contact holes 56B for intercommunication

between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55." Ex. 1003 at 7:46–51.

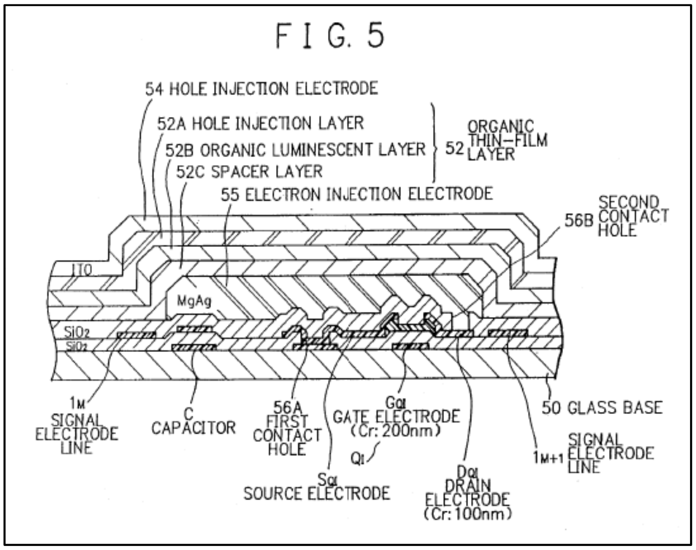
89. Finally, Utsugi teaches that the electron injection electrode 55 "consist[s] of a metallic material MgAg." Ex. 1003 at 6:47–50. A POSA would understand a metallic, magnesium-based electrode would reflect light from the organic thin film layer 52, as well as shield the active elements, i.e., the transistors. *See, e.g.,* Ex. 1001 at 2:16–20 ("Since the cathode electrode 107 is normally formed of a metal such as magnesium whose work function is low, the cathode electrode 107 reflects light having a wavelength in a range of wavelength of light which the organic EL layer 106 emits."); *see also*, Ex. 1001 at 8:49–54. In fact, the '450 patent discloses a first electrode (cathode 15) formed from the same material. Ex. 1001 at 17:25–27 ("The cathode electrodes 15 having such rough surfaces can be formed using an Mg material doped with Ag.").

90. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

> **1[e]: an organic electroluminescent layer having an organic electroluminescent material formed on said at least one first electrode so as to cover said active elements and including at least one layer which emits light in accordance with a voltage applied to said at least one layer;**

91. Utsugi discloses limitation 1[e]. First, Utsugi discloses an organic electroluminescent layer that includes an organic electroluminescent material, and

that is formed on the first electrode. As shown in Figure 5 below, Utsugi teaching that an organic thin-film layer 52 is formed directly on electron injection electrode 55.



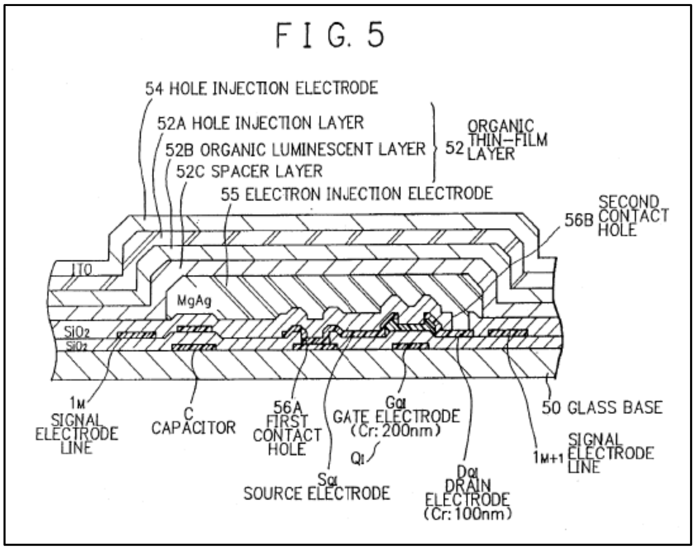
92. Second, Utsugi discloses that organic thin-film layer 52 comprises an organic luminescent layer 52B, which emits light in accordance with a voltage applied to said at least one layer. "[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54." Ex. 1003 at 6:59–63; *see also* Ex. 1003 at 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce.").

93. Third, as shown in Figure 5 above, Utsugi teaches that the organic thin-film layer is formed such that it covers the current-controlling transistor Q_I. While Figure 5 does not depict switching transistor Q_S, Utsugi teaches that the entire "luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003 at 6:23–29. Therefore, a POSA would understand that Utsugi teaches organic thin-film layer 52 as covering the switching transistor Q_S as well. Indeed, Utsugi specifically states that "the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel." 1003 at 6:53–59.

94. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

1[f]: at least one second electrode formed on said organic electroluminescent layer which covers said active elements

95. Utsugi discloses limitation 1[f]. First, Utsugi discloses a second electrode formed on the organic electroluminescent layer. Specifically, as shown in Figure 5 below, Utsugi teaches that the hole injection electrode 54 is formed directly on the organic thin-film layer.



96. Second, as shown in Figure 5 above, Utsugi teaches that the hole injection electrode 54 is formed such that it covers the current-controlling transistor Q_I. While Figure 5 does not depict switching transistor Q_S, Utsugi teaches that the entire "luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003 at 6:23–29. Therefore, a POSA would understand that Utsugi teaches hole injection electrode 54 as covering the switching transistor Q_S as well. Indeed, Utsugi specifically states that "the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel." 1003 at 6:53–59.

97. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

b. Dependent Claim 2

The display apparatus according to claim 1, wherein said at least one first electrode is formed of a conductive material containing magnesium.

98. Utsugi discloses that the first electrode, i.e., the electron injection electrode 55, can be formed of a material containing magnesium. As I described above with respect to claim 1, Utsugi teaches that the electron injection electrode 55 can "consist[] of a metallic material MgAg." Ex. 1003 at 6:47–50. Utsugi further teaches that electron injection electrode 55 can be formed of other materials containing magnesium, including Mg and Mg:In. Ex. 1003 at 9:11–13.

99. A POSA would appreciate that metals such as Mg, MgAg, and Mg:In would be conductive. Furthermore, a POSA would appreciate that the electrode would need to be conductive to serve its function of inducing charge to the organic electroluminescent layer.

100. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

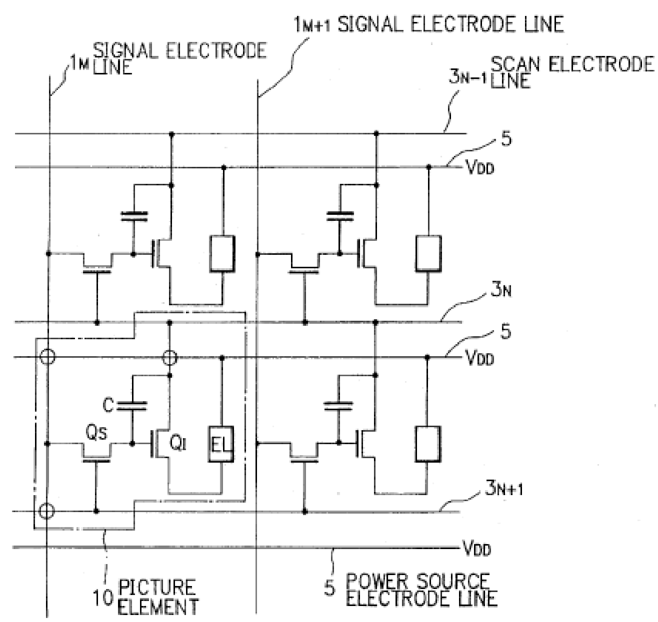
c. Dependent Claim 4

4[a] The display apparatus according to claim 1, wherein said active elements are a selection transistor which is turned on in response to an externally supplied address signal

101. Utsugi discloses a selection transistor, i.e., its switching transistor Q_S. As I previously described, and as is illustrated in Figure 3 below, the gate of the

switching transistors Q_S is directly connected to the scan electrode line 3_{N+1}, i.e., "[f]or the switching transistors Q_S in this picture element, the scan electrode line 3_{N+1} extending in the (N+1)-th row of the array provides a straight branch that constitutes a gate electrode G_{QS} of the transistors Q_S." Ex. 1003 at 7:9–12. Given that the scan electrode lines address the rows of the various pixels in Utsugi's display, a POSA would appreciate that they are serving the role of address lines.

FIG. 3



102. When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. Therefore, Utsugi discloses that the switching transistor Q_S is turn on in response to the externally supplied address signal.

103. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

4[b] and a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer,

104. Utsugi discloses a drive transistor, i.e., its current-controlling transistor Q_I. As I described above, when "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. "The signal electrode line 1_M in the M-th column then has a line voltage thereof imposed via the switching transistor Q_S on the charge holding capacitor C," and the gate of the current-controlling transistors Q_I. Ex. 1003 at 8:13–16. Given that the device described in Utsugi is for "display purpose[s]," Ex. 1003 at 1:6–12, a POSA would appreciate that the data from the signal electrode line would correspond to image data. Accordingly, image data is supplied externally from the electrode line through the switching transistor.

105. Utsugi discloses that the current-controlling transistor controls the current, and thus the voltage, applied to the organic electroluminescent layer: "when an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54." Ex. 1003 at 6:59–63; *see also* Ex. 1003 at 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element

EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce.”).

4[c] said selection transistor and said drive transistor forming a pair.

106. Utsugi discloses the claimed pair of selection and drive transistors, i.e., its transistors Q_S and Q_I. Utsugi teaches the use of “a pair of reversely staggered a-SiTFT (amorphous silicon thin-film transistor)’s as a switching transistor and a current-controlling transistor, in combination with an organic thin-film EL element as a luminescent luminous element.” Ex. 1003 at 5:50–56.

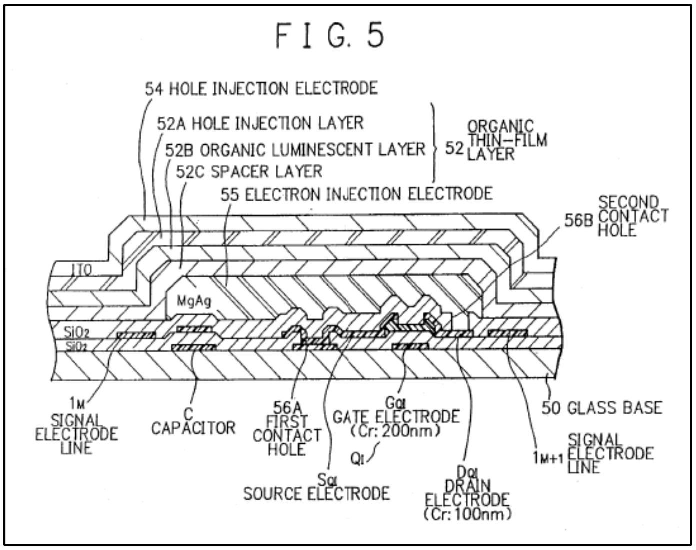
107. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

d. Dependent Claim 5

The display apparatus according to claim 4, wherein said at least one first electrode is connected to said drive transistor through said at least one contact hole.

108. As discussed above with respect to element 1[d], Utsugi discloses that the first electrode is connected to the drive transistor through a contact hole. As shown in Figure 5 below, Utsugi teaches that “electrode 55 is connected through second contacts in second contact holes 56B to a drain electrode $[D]_{QI}$ of the current-controlling transistor Q_I.” Ex. 1003 at 6:50–52. Utsugi explains that an etching process is used to “open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the

electron injection electrode 55 to be formed as a lower electrode of the organic thin-film EL element." Ex. 1003 at 7:46-51.



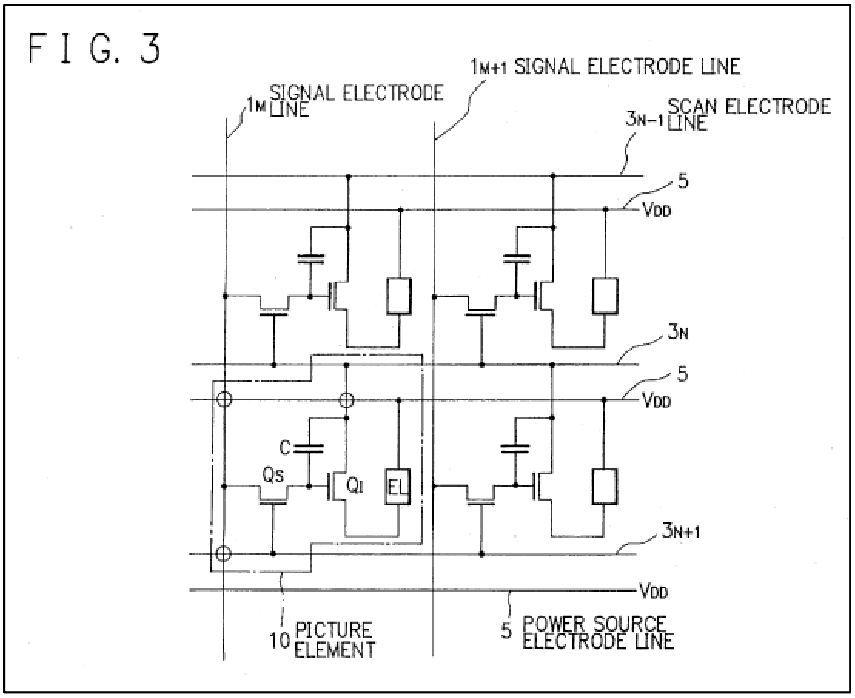
109. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

e. Dependent Claim 6

6[a]: The display apparatus according to claim 4, wherein: said display apparatus further comprises a capacitor for retaining the signal corresponding to the image data externally supplied through said selection transistor while said selection transistor is on; and

110. Utsugi discloses the required capacitor, i.e., the charge holding capacitor C. As shown below in Figure 3, Utsugi teaches that when "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. "The signal electrode line 1_M in the M-th column then has a line voltage thereof imposed via the switching transistor Q_S on the charge holding capacitor C." Ex. 1003 at 8:13–16. As explained with respect to limitation 6[b] below, the voltage

from the signal corresponding to the image data is retained by the capacitor, and is held when the switching transistor is turned off.



111. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

6[b]: while said selection transistor is off, said drive transistor is driven by the signal retained in said capacitor.

112. Utsugi discloses that the capacitor stores the signal provided from the signal electrode line 1_M and, when the selection transistor is off, applies the signal to the gate of the current-controlling transistor Q_I. Utsugi teaches that when "the scan electrode line 3_{N+1} enters a non-selected state," "[t]he switching transistor Q_S then turns off, and the charge holding capacitor C holds thereacross the imposed voltage

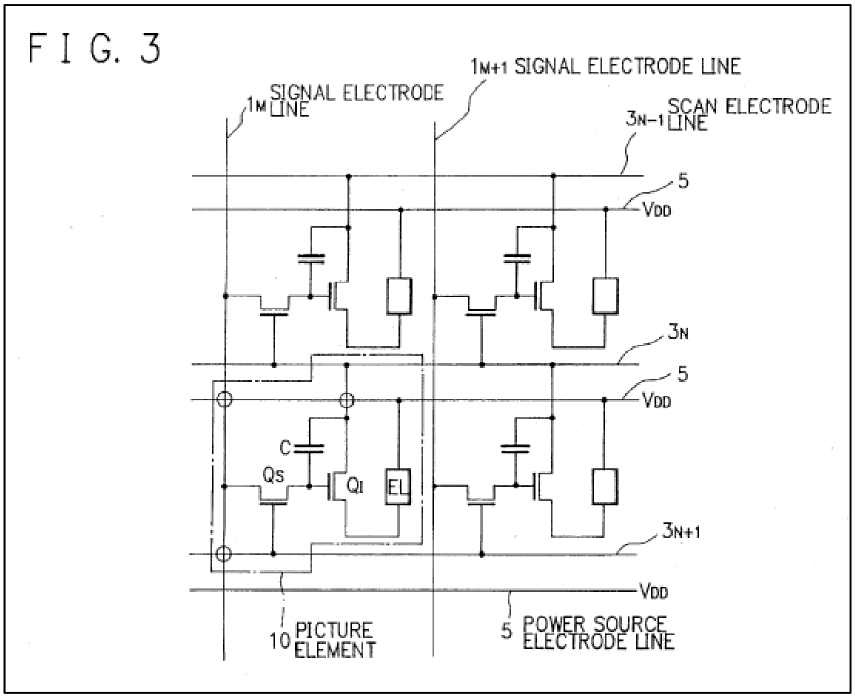
from the signal electrode line 1_M." Ex. 1003 at 8:16–31. Therefore, when transistor Q_S is turned off, the voltage stored on the capacitor drives transistor Q_I.

113. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

f. Dependent Claim 7

7[a]: The display apparatus according to claim 1, wherein: said active elements are transistors forming pairs and arranged in a matrix pattern,

114. Utsugi disclose the above limitation. As described with respect to claim 4, Utsugi discloses pairs of transistors used to drive the individual pixels, i.e., "a pair of reversely staggered a-SiTFT (amorphous silicon thin-film transistor)'s as a switching transistor and a current-controlling transistor, in combination with an organic thin-film EL element as a luminescent luminous element." Ex. 1003 at 5:50–56. Utsugi teaches that the transistors, along with each luminous element, are "arranged in the form of a matrix between a plurality of signal electrode lines and a plurality of scan electrode lines." Ex. 1003 at 4:5–21. A portion of the matrix pattern can be seen in Figure 3 below.



115. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

7[b] one transistor of each of said pairs being a selection transistor which is turned on in response to an externally supplied address signal, and

116. Utsugi discloses this limitation. Utsugi discloses that the selection transistor Q_S is turned on in response to an externally supplied address signal.

117. As is illustrated in Figure 3, the gate of the switching transistors Q_S is directly connected to the scan electrode line 3_{N+1}, i.e., "[f]or the switching transistors Q_S in this picture element, the scan electrode line 3_{N+1} extending in the (N+1)-th row of the array provides a straight branch that constitutes a gate electrode G_{QS} of the transistors Q_S." Ex. 1003 at 7:9–12. Given that the scan electrode lines address the rows of the various pixels in Utsugi's display, a POSA would appreciate that they

are serving the role of address lines. When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. Therefore, Utsugi discloses that the switching transistor Q_S is turn on in response to the externally supplied address signal.

118. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

7[c] the other transistor of each of said pairs being a drive transistor, which is driven by a signal corresponding to image data supplied externally through said selection transistor while said selection transistor is on, for controlling a voltage to be applied to said organic electroluminescent layer;

119. Utsugi discloses a drive transistor, i.e., its current-controlling transistor Q_I. As I described above, when "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. "The signal electrode line 1_M in the M-th column then has a line voltage thereof imposed via the switching transistor Q_S on the charge holding capacitor C," and the gate of the current-controlling transistors Q_I. Ex. 1003 at 8:13–16. Given that the device described in Utsugi is for "display purpose[s]," Ex. 1003 at 1:6–12, a POSA would appreciate that the data from the signal electrode line would correspond to image data. Accordingly, image data is supplied externally from the electrode line through the switching transistor.

120. Utsugi discloses that the current-controlling transistor controls the current, and thus the voltage, applied to the organic electroluminescent layer: "when an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the transparent electrode 54." Ex. 1003 at 6:59–63; *see also* Ex. 1003 at 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce.").

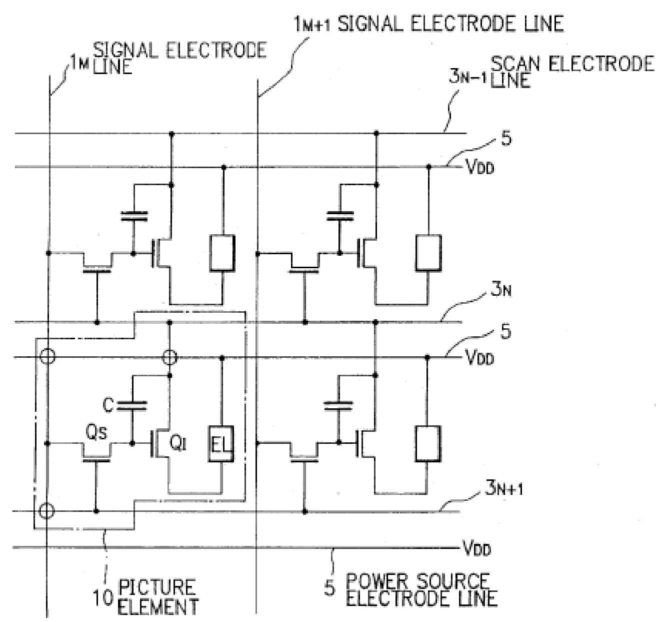
121. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

> **7[d]: said selection transistor of each of said pairs is connected to one of address lines and one of data lines, said address lines being formed over said substrate and being supplied with said address signal, and one of said data lines being formed over said substrate and being supplied with said image data; and**

122. Utsugi discloses the above limitation. Utsugi discloses that the active matrix is formed of scan electrode lines (address lines) and signal electrode lines (data lines). As shown in Figure 3 below, Utsugi teaches that the gate of the switching transistor is directly connected to the signal electrode line. Ex. 1003 at 7:9–12 ("For the switching transistors Q_S in this picture element, the scan electrode line 3_{N+1} extending in the (N+1)-th row of the array provides a straight branch that

constitutes a gate electrode G_{QS} of the transistors Q_S."). Thus, a POSA would understand that the signal electrode line supplies the switching transistor with an address signal that the signal electrode line receives. The source electrode of switching transistor Q_S in turn is connected to the signal electrode line. Ex. 1003 at 8:11–16. Thus, a POSA would understand that the signal electrode line receives image data and supplies the image data to the gate of the current-controlling transistor Q_I through the switching transistor Q_s.

FIG. 3



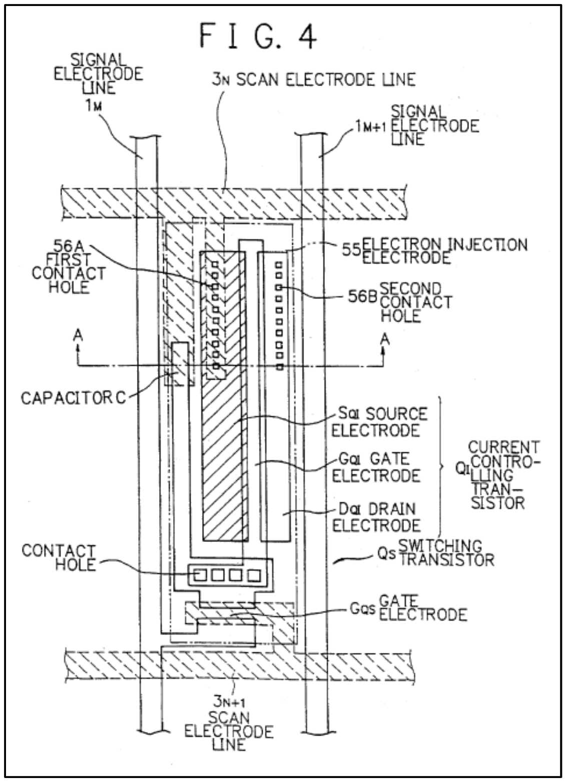
123. Utsugi teaches that both the scan electrode line and signal electrode line are formed over the substrate, i.e., glass base 50. Utsugi explains that, "[f]irst, on the glass base 50 is grown a Cr layer 200 nm thick," and "[t]hen a patterning process is executed for the scan electrode lines 3_N and 3_{N+1}." Ex. 1003 at 7:20–25. In the

second metal layer, "a Cr layer 100 nm thick is deposited and pattern-processed to provide the signal electrode line 1_M." Ex. 1003 at 7:35–40.

124. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

7[e]: said at least one first electrode is plural in number, and the plurality of first electrodes are arranged in a matrix pattern in areas surrounded by said address lines and said data lines.

125. Utsugi discloses that the first electrode is plural in number and is arranged in a matrix pattern surround by said address lines and said data lines. As shown in Figure 4 below, "the electron injection electrode 55 is patterned like an independent i[s]land in each picture element region." Ex. 1003 at 6:53–59. As is clear from the figure, the electron injection electrode 55 is surrounded by the scan electrode line (address line) and signal electrode line (data line). Given that the electron injection electrode is formed as an island in each picture element region, a POSA would understand that that the electron injection electrode would be plural in number, one for each pixel, and therefore arranged in a matrix pattern.



126. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

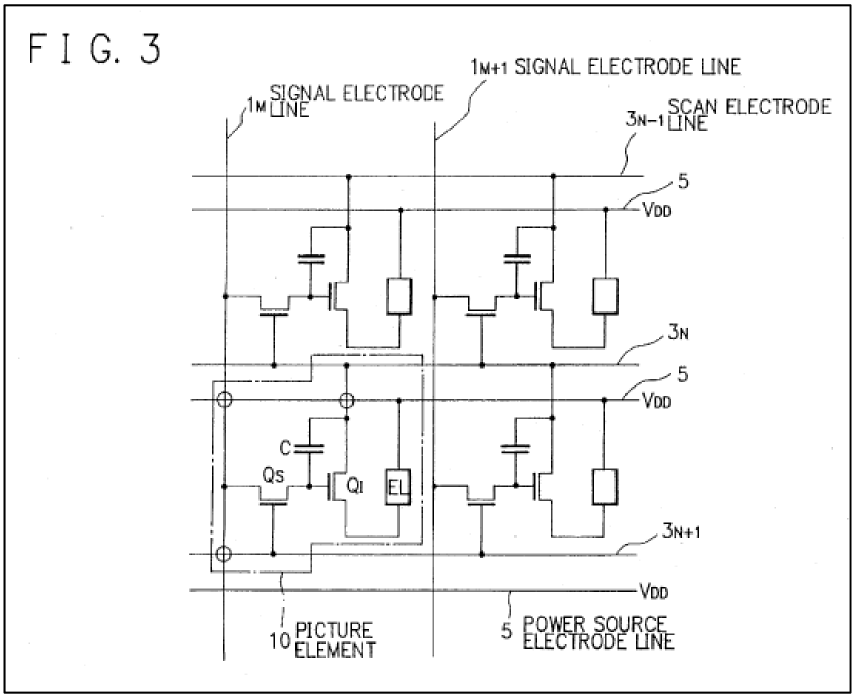
g. Dependent Claims 8 and 16

The display apparatus according to claim [1/15], wherein a constant voltage is applied to said second electrode.

127. Given that the only difference between claims 8 and 16 is the independent claim from which they depend—claim 8 depends from independent claim 1 and claim 16 depends from independent claim 15—I have decided to address these claims together.

128. Utsugi discloses a constant voltage applied to the hole injection electrode 54. As shown in Figure 3 below, the hole injection electrode 54

"corresponds to a power source electrode line 5 shown in Figure 3." Ex. 1003 at 6:43–47.



129. The power source electrode line 5 applies a voltage V_{DD}. A POSA would appreciate that the term V_{DD} is understood to refer to a direct current (DC) supply, as opposed to an alternating current (AC) supply, and would thus refer to a constant voltage source. Ex. 1006 at App. D, p. 387 (defining V_{DD} as "Supply voltage, d.c."). Consistent with that understanding, Utsugi described an experiment of the first embodiment "with a drive voltage of 7 V applied [across the organic-thin-film EL element]." Ex. 1003 at 8:32–40. Given that the source electrode of the current-controlling transistor Q_I is connected to the scan electrode line of a different row, e.g., 3_N, a POSA would understand that the scan electrode line 3_N would not be asserted when the electroluminescent element is being turned on. Accordingly, a

POSA would expected that the drive voltage of 7 V would be applied as a constant voltage on the hole injection electrode 54.

130. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

h. Claim 15

15 [preamble]: A display apparatus comprising:

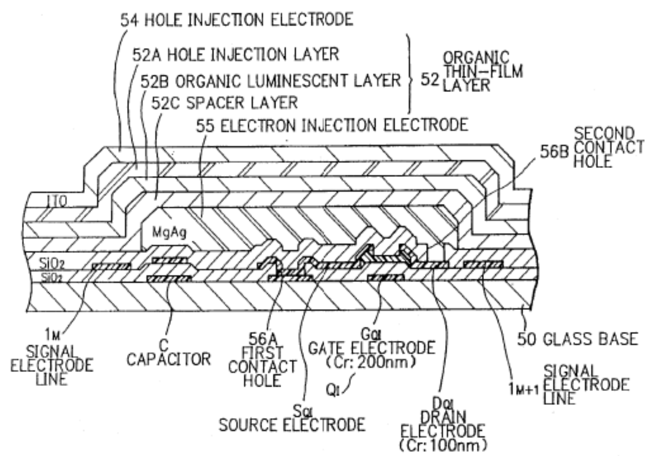
131. Utsugi discloses a display apparatus—specifically, in the "Background Of The Invention" section, Utsugi states that "[t]he present invention relates to a current-controlled luminous element array and a method for producing the same, and in particular to a current-controlled luminous element array of an active matrix type such as for a display purpose." Ex. 1003 at 1:6-9.

132. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[a]: a substrate;

133. Utsugi discloses a substrate, i.e., "glass base 50," shown in Figure 5 below. Utsugi states that "The EL element includes an organic thin-film layer 52 of a three-layered structure having a spacer layer 52C, an organic luminescent layer 52[B] and a hole injection layer 52A laminated in this over a glass base 50." Ex. 1003 at 6:37–50.

FIG. 5



134. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[b]: selection transistors formed over said substrate and arranged in a matrix pattern;

135. Utsugi discloses switching transistors Q_S, selection transistors, formed over glass base 50. Ex. 1003 at 7:20–45. Utsugi teaches that switching transistors Q_S are "arranged in the form of a matrix between a plurality of signal electrode lines and a plurality of scan electrode lines." Ex. 1003 at 4:5–21.

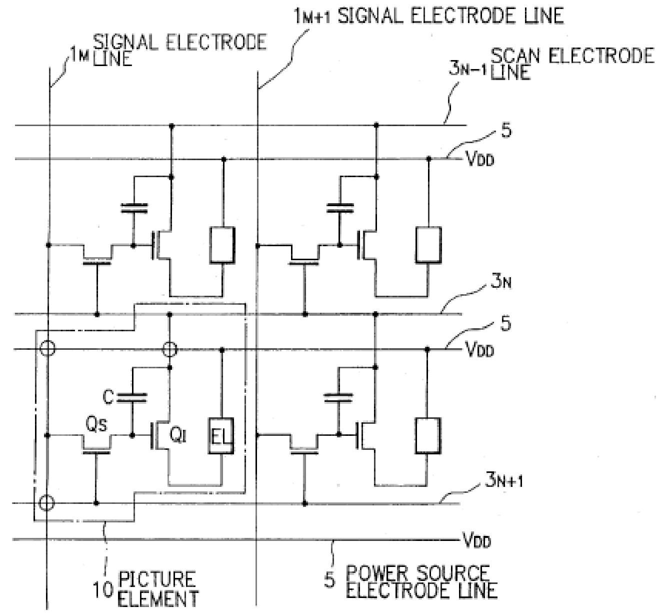
136. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[c]: drive transistors formed over said substrate and arranged in a matrix pattern, each of said drive transistors being connected to one of said selection transistors;

137. As shown in Figure 5, Utsugi discloses current-controlling transistor Q_I, a drive transistor, formed over glass base 50. Ex. 1003 at 7:20–45. Utsugi

teaches that current-controlling transistor Q_I is "arranged in the form of a matrix between a plurality of signal electrode lines and a plurality of scan electrode lines." Ex. 1003 at 4:5–21. As illustrated in Figure 3 below, the gate of the current-controlling transistor Q_I is connected switching transistor Q_S.

FIG. 3



138. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[d]: address lines connected to said selection transistors and through which a signal for turning on said selection transistors is supplied;

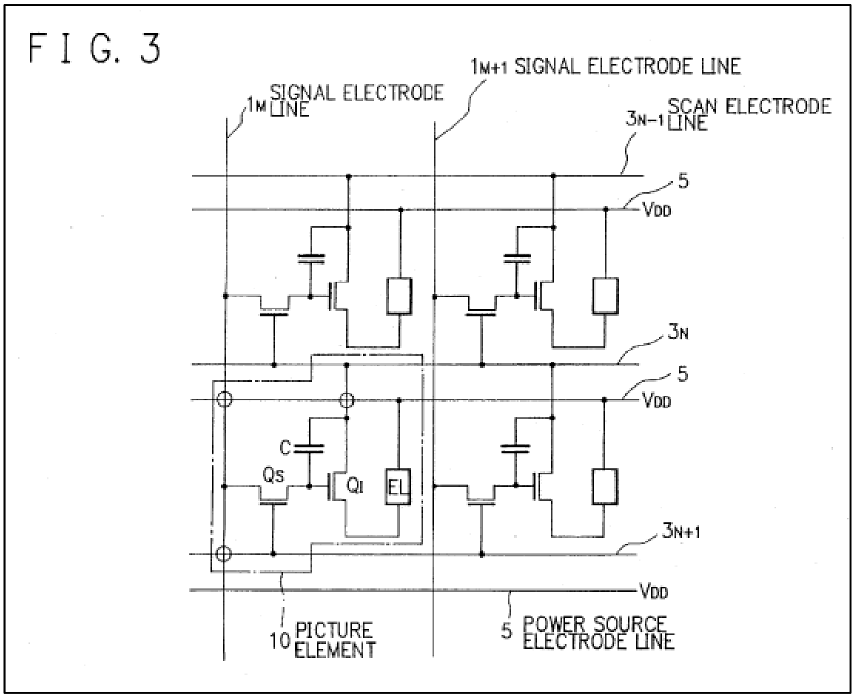
139. Utsugi discloses scan electrode lines 3_{N+1} (address lines) connected to the switching transistors Q_S through which a signal for turning on the switching transistors Q_S is applied. Utsugi teaches that "[f]or the switching transistor Qs in this picture element, the scan electrode line 3_{N+1} extending in the (N+1)-th row of

the array provides a straight branch that constitutes a gate electrode G_{QS} of the transistor Q_S." Given that the scan electrode lines address the rows of the various pixels in Utsugi's display, a POSA would appreciate that they are serving the role of address lines. When "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–16. Therefore, the switching transistor is turned on in response to a signal from an address line.

140. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[e]: data lines connected to said selection transistors, a signal which corresponds to image data being supplied to said drive transistors through said data lines and said selection transistors while said selection transistors are on;

141. Utsugi discloses signal electrode lines 1_M (data lines) that supply image data through the switching transistors Q_S to the current-controlling transistors Q_I. Utsugi teaches that when "the scan electrode line 3_{N+1} is selected, the switching transistor Q_S is turned on." Ex. 1003 at 8:11–13. "The signal electrode line 1_M in the M-th column then has a line voltage thereof imposed via the switching transistor Q_S on the charge holding capacitor C," and, as shown in Figure 3 below, the gate of the current-controlling transistors Q_I. Ex. 1003 at 8:13–16.



142. Given that the device described in Utsugi is for "display purpose[s]," Ex. 1003 at 1:6–12, a POSA would appreciate that the data from the signal electrode line would correspond to image data. *See also* Ex. 1003 at 3:66–4:4 ("It is therefore an object of the present invention to provide a current controlled luminous element array of a high quality active matrix type having a significantly reduced tendency to image quality deteriorations.").

143. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

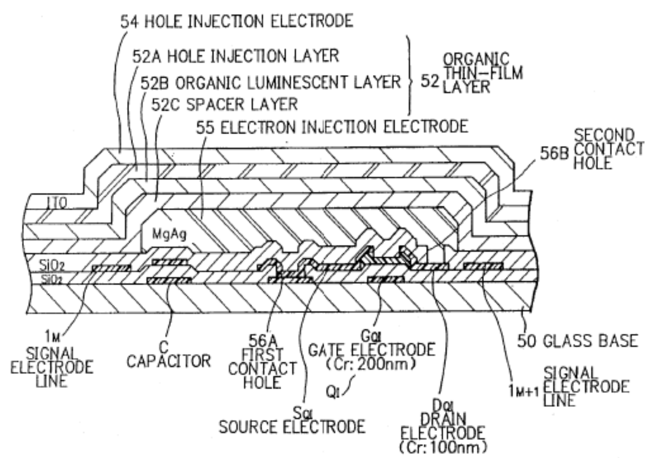
15[f]: an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors;

144. Utsugi discloses an insulation film formed over the substrate, which covers the drive transistors, address lines, and data lines, and which has a contact hole formed corresponding to the drive transistor.

145. Utsugi teaches that after current-controlling transistor Q_I, scanning electrode lines 3_N, and signal electrode lines 1_M are formed on the substrate, Ex. 1003 at 7:20–45, "a SiO_2 layer is let grow 200 nm," Ex. 1003 at 7:46-51.

146. As shown in Figure 5 below, the SiO_2 layer covers the current-controlling transistor Q_I and the signal electrode line 1_M.

FIG. 5



147. A POSA would appreciate that the SiO_2 layer would be formed above the scanning electrode line 3_N. The scanning electrode line 3_N is formed in the same metal layer as the gate electrode G_{QI} for the current-controlling transistor Q_I, shown in Figure 5. Ex. 1003 at 7:20–25. As I previously described, in semiconductor manufacturing, layers of materials are generally applied or grown sequentially,

starting with the substrate. The layers can be deposited on select areas of the substrate, using, for instance, a mask, or the layers can be applied across the entire substrate, and portions can subsequently be removed using processes such as etching. Utsugi describes the latter technique, i.e., the SiO_2 layer appears to be deposited across the entire substrate. It is then subsequently etched to form the second contact hole 56B. Ex. 1003 at 7:46-51. Given that Utsugi describes etching the second contact hole 56B, but not does not describe any further patterning, a POSA would expect that the insulation film would cover the remainder of the substrate, including scanning electrode line 3_N.

148. Finally, as just mentioned, a contact hole 56B is etched through the SiO_2 layer "for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55 to be formed as a lower electrode of the organic thin-film EL element." Ex. 1003 at 7:46-51.

149. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

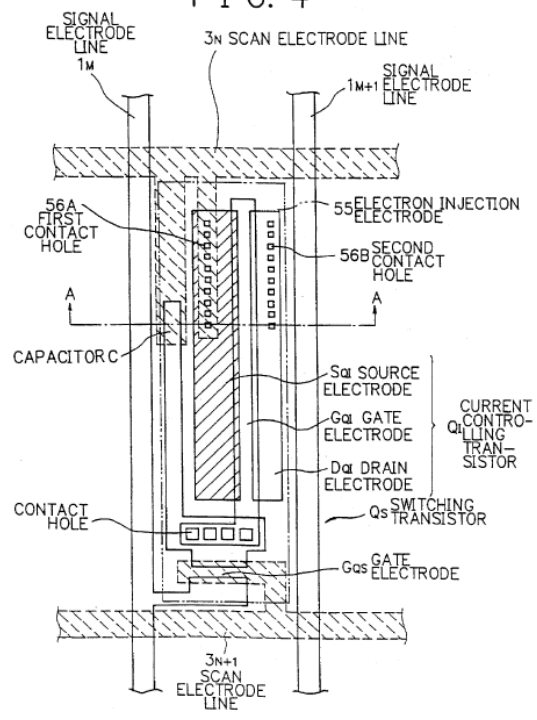
> **15[g]: first electrodes made of a material which shields visible light, and formed on said insulation film so as to cover said selection transistors and said drive transistors, said first electrodes being arranged in a matrix pattern in areas surrounded by said address lines and said data lines, and being connected to said drive transistors through said contact holes;**

150. Utsugi discloses the above limitation. First, Utsugi teaches that the electron injection electrode "consist[s] of a metallic material MgAg." Ex. 1003 at

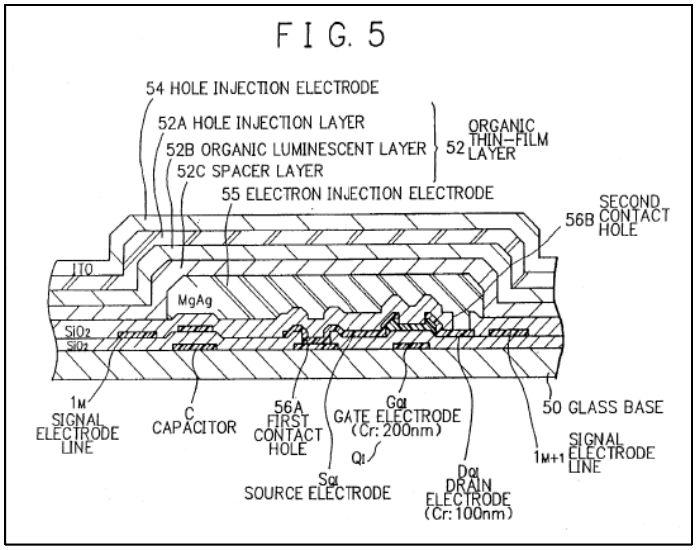
6:47–50. A POSA would understand a metallic, magnesium-based electrode would reflect light from the organic thin film layer 52, as well as shield the active elements, i.e., the transistors. *See, e.g.,* Ex. 1001 at 2:16–20 ("Since the cathode electrode 107 is normally formed of a metal such as magnesium whose work function is low, the cathode electrode 107 reflects light having a wavelength in a range of wavelength of light which the organic EL layer 106 emits."); *see also*, Ex. 1001 at 8:49–54. In fact, the '450 patent discloses a first electrode (cathode 15) formed from the same material. Ex. 1001 at 17:25–27 ("The cathode electrodes 15 having such rough surfaces can be formed using an Mg material doped with Ag.").

151. Second, as shown in Figure 4 below, the electron injection electrode 55 covers the switching transistor Q_S and the current-controlling transistor Q_I. As explained by Utsugi, the entire "luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region," but only the electron injection electrode 55 is shown in Figure 4, "to avoid a complicated drawing." Ex. 1003 at 6:23–29. As is further clear from Figure 4 below, the electron injection electrodes 55 are arranged in a matrix pattern, surrounded by the scan and signal electrode lines.

FIG. 4



152. Third, as shown in Figure 5 below, prior to the deposition of the electron injection electrode 55, the SiO_2 layer is etched to "open the second contact holes 56B for intercommunication between the source electrode S_{QI} of the current-controlling transistor Q_I and the electron injection electrode 55 to be formed as a lower electrode of the organic thin-film EL element." Ex. 1003 at 7:46–51.



153. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

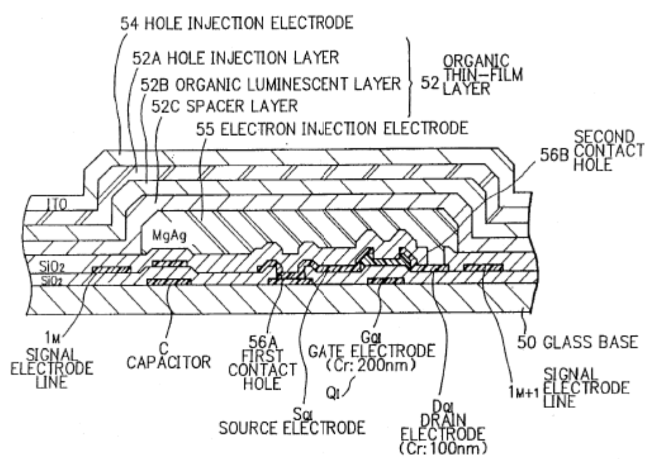
15[h]: an organic electroluminescent layer formed on said first electrodes which covers said selection transistors and said drive transistors and including at least one layer which emits light in accordance with an applied voltage;

154. Utsugi discloses an organic electroluminescent layer that includes a layer which emits light in accordance with an applied voltage, and that is both formed on the first electrode and formed so as to cover the active elements.

155. As shown in Figure 5 below, Utsugi teaching that an organic thin-film layer 52 is formed directly on electron injection electrode 55. Organic thin-film layer 52 comprises an organic luminescent layer 52B, which emits light in accordance with an applied voltage. "[W]hen an arbitrary picture element is selected to be driven, there develops an electric field acting thereon, causing the organic luminescent layer 52B to luminesce, externally emitting flux of light through the

transparent electrode 54." Ex. 1003 at 6:59–63; *see also* Ex. 1003 at 8:20–28 ("[A]n electric current runs through an established conducting route: the power source electrode line 5→the luminescent element EL→the transistor Q_I→the scan electrode line causing the luminescent element EL to luminesce.").

FIG. 5



156. As shown in Figure 5 above, Utsugi teaches that the organic thin-film layer is formed such that it covers the current-controlling transistor Q_I. While Figure 5 does not depict switching transistor Q_S, Utsugi teaches that the entire "luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003 at 6:23–29. Therefore, a POSA would understand that Utsugi teaches organic thin-film layer 52 as covering the switching transistor Q_S as well. Indeed, Utsugi specifically states that "the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the

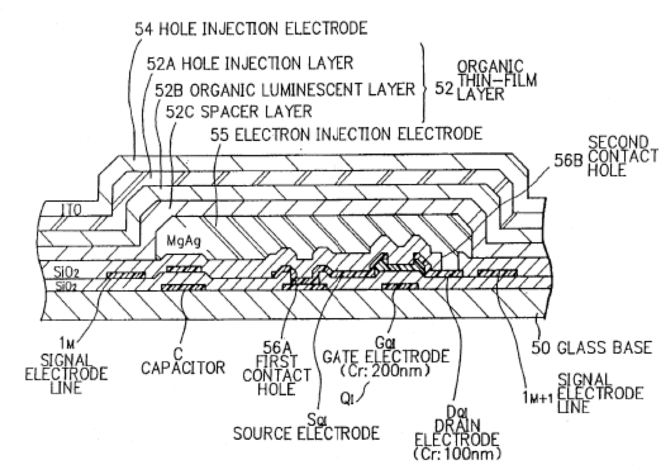
luminous element array, i.e., formed over the entire region of a display panel." 1003 at 6:53–59.

157. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[i]: a second electrode formed on said organic electroluminescent layer which covers said selection transistors and said drive transistors;

158. Utsugi discloses a second electrode formed on the organic electroluminescent layer. Specifically, as shown in Figure 5 below, Utsugi teaches that the hole injection electrode 54 is formed directly on the organic thin-film layer 52.

FIG. 5



159. As shown in Figure 5 above, Utsugi teaches that the hole injection electrode 54 is formed such that it covers the current-controlling transistor Q_I. While Figure 5 does not depict switching transistor Q_S, Utsugi teaches that the entire

"luminescent element EL as a layered organic thin-film EL element extends over the capacitor C and the transistors Q_I and Q_S, covering substantially the entirety of the picture element region." Ex. 1003 at 6:23–29. Therefore, a POSA would understand that Utsugi teaches hole injection electrode 54 as covering the switching transistor Q_S as well. Indeed, Utsugi specifically states that "the organic thin-film layer 52 and the hole injection electrode 54 are made common to the whole picture elements of the luminous element array, i.e., formed over the entire region of a display panel." 1003 at 6:53–59.

160. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[j]: a first driver circuit for selectively supplying said address signal to said address lines in sequence; and

161. A POSA would appreciate that the invention disclosed in Utsugi would include a first driver circuit for selectively supplying address signals to address lines in sequence. As describer earlier in my declaration, in both active and passive matrix displays, an image is conventionally displayed by cycling through address lines, one at time, and providing signals on select data lines. By cycling through each address line, an entire image can be displayed. Consistent with that approach, Utsugi teaches that "[i]n the active matrix type luminous element array, the row selection is performed by sequentially selecting corresponding one of row-addressed scan electrode lines." Ex. 1003 at 8:59–62.

162. Utsugi does not discuss the circuitry used to select each row-addressed scan electrode line; however, a POSA would appreciate that some form of circuitry would be necessary to perform this operation. The above limitation does not require any particular type of circuitry.

163. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

15[k]: a second driver circuit for supplying said image data to said data lines.

164. A POSA would appreciate that the invention disclosed in Utsugi would include a second driver circuit for selectively supplying image data to data lines. As describer earlier in my declaration, in both active and passive matrix displays, an image is conventionally displayed by cycling through address lines, one at time, and providing signals on select data lines. By cycling through each address line, an entire image can be displayed. Consistent with that approach, Utsugi teaches that, as shown in Figure 3, each pixel is connected to a signal electrode line $1_{M.}$

165. Utsugi does not discuss the circuitry used to select each signal electrode line; however, a POSA would appreciate that some form of circuitry would be necessary to perform this operation. The above limitation does not require any particular type of circuitry.

166. Accordingly, a POSA would have appreciated that Utsugi discloses this claim limitation.

X. THE SUGGESTION OF CLAIMS 1–2, 4–8, AND 15–16 BY UTSUGI

167. As described in the previous section, in my opinion, Utsugi discloses all of the limitations of claims 1–2, 4–8, and 15–16. However, with respect to a number of limitations (1[c], 8/16, 15[f], 15[j/k]), I have been asked to provide my opinion as to whether, assuming these limitations were not disclosed by Utsugi, a POSA would have been motivated to modify the device described in Utsugi (with a reasonable expectation of success), at the time of the alleged invention of the '450 patent, such that the device would include the structure described by these limitations. I discuss each of these limitations in turn below. For convenience, I have not repeated my analysis for the remaining limitations of claims 1–2, 4–8, and 15–16.

a. Claim 1[c]

1[c]: an insulation film formed over said substrate so as to cover said active elements, said insulation having at least one contact hole;

168. As previously discussed, based on the manufacturing method taught in Utsugi, a POSA would expect that the SiO_2 layer would cover the entire device, other than the portion described as being etched for the second contact hole 56B. However, to the extent there is any question, a POSA would have been motivated to deposit the SiO_2 layer such that it covers the switching transistor Q_S. The purpose of the SiO_2 layer is to insulate certain metal layers from one another—in this case, the metal layer comprising the source and drain electrodes of the transistors from the

metal layer comprising the electron injection electrode 55. Absent an SiO_2 layer over the switching transistor Q_S, the source and drain electrodes of the switching transistor Q_S would be able to make physical and electrical contact with the electron injection electrode 55, which would cause the metal layers to short circuit, and the device to malfunction.

169. Depositing the SiO_2 layer above the switching transistor Q_S would be well within the knowledge and skill of a POSA, in particular given that the SiO_2 layer is already being deposited elsewhere on the substrate. Indeed, Figure 23 below illustrates a passivation layer 104 as covering both a selection and drive transistor. Notably, while the "Brief Description Of The Drawings" section of the '450 patent describes Figure 23 as a "sectional view of the display apparatus illustrated in FIG. 21," Figure 23 is discussed exclusively in the "Description Of The Related Art" section and appears to be a cross-section of the related art shown in Figure 22. Thus, Figure 23 demonstrates that this was common practice before the alleged invention of the '450 patent.

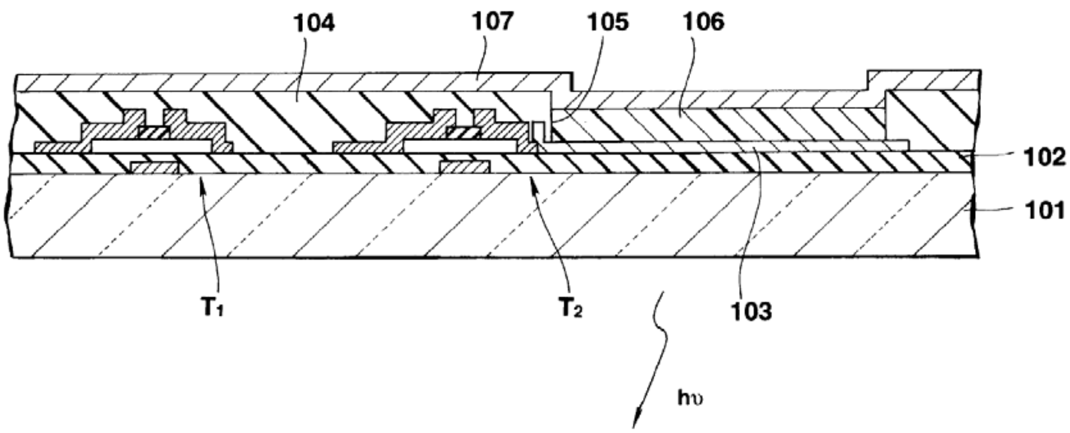


FIG.23

170. Accordingly, even assuming that Utsugi does not disclose this limitation, a POSA would have been motivated to modify Utsugi in a way that satisfies this limitation, and would have reasonably expected success in doing so.

b. Dependent Claims 8 and 16

The display apparatus according to claim [1/15], wherein a constant voltage is applied to said second electrode.

171. As I discussed above, in my opinion, a POSA would understand Utsugi as disclosing this limitation. However, to the extent there is any question, a POSA would have been motivated to apply a constant voltage to the hole injection electrode 54 of Utsugi. There are a limited number of options available to a POSA in designing the device described in Utsugi. A POSA could use an AC voltage or a DC voltage. With respect to the DC voltage, a POSA could use a constant voltage or a pulse. Of these options, a POSA would appreciate that a constant DC voltage

would be the most appropriate for the application needed in Utsugi, i.e., to drive the electroluminescent element.

172. The voltage applied to the electroluminescent element is directly related to the brightness of the light. A constant DC voltage would allow for the electroluminescent element to hold a constant brightness for a frame of an image. If the voltage was pulsed or alternating, the brightness of the electroluminescent element would similarly change, which would be noticeable to the viewer, for instance, as a flicker. This would defeat the purpose of the circuit described in Utsugi, which includes a hold capacitor specifically to keep the voltage across the electroluminescent element constant for an entire frame.

173. Using a constant voltage would be well within the knowledge and skill of a POSA. Indeed, Figure 22 below of the '450 patent, which illustrates the "Related Art" specifically depicts "[t]he source of the drive transistor T2 is connected to a constant voltage line VL," which is used to apply a constant voltage across the electroluminescent element. Ex. 1001 at 1:56–58.

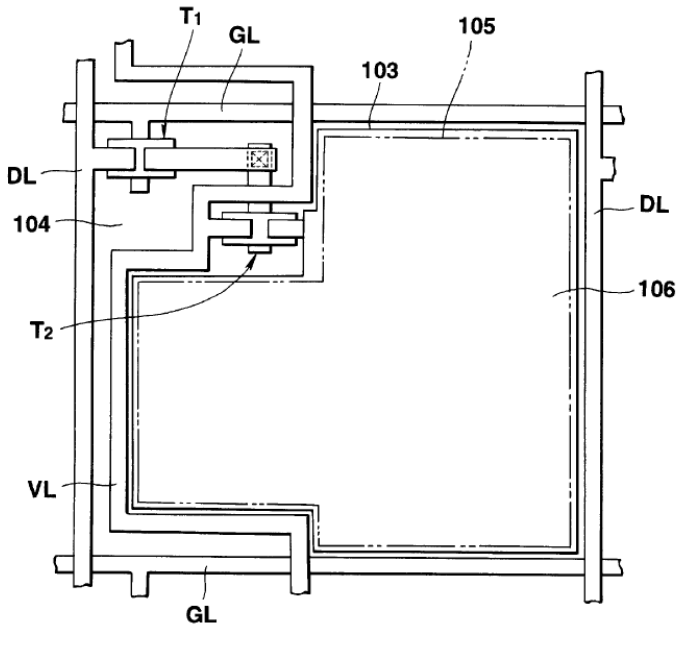


FIG.22

174. Accordingly, even assuming that Utsugi does not disclose this limitation, a POSA would have been motivated to modify Utsugi in a way that satisfies this limitation, and would have reasonably expected success in doing so.

c. Claim 15[f] and 15[j/k]

15[f]: an insulation film formed over said substrate so as to cover said drive transistors, said address lines and said data lines, said insulation film having contact holes formed in correspondence with said drive transistors;

175. As previously discussed, based on the manufacturing method taught in Utsugi, a POSA would expect that the SiO_2 layer would cover the entire device, other than the portion described as being etched for the second contact hole 56B.

176. Figure 5 of Utsugi expressly illustrates the SiO_2 layer as covering the drive transistor (current-controlling transistor Q_I) and the data line (signal electrode

line 1_M). While the scan electrode line 3_N is not illustrated in the figure, a POSA would expect it to be similarly covered. The scan electrode line 3_{N+1} is formed in the same metal layer as the lower electrode of the capacitor C and the gate electrode G_{QI}. Ex. 1003 at 7:20–25. Both of these elements are covered by the SiO_2 layer. A POSA would expect the scan electrode line 3_{N+1} to be similarly covered, so as to be further insulated from other metal layers. As would be appreciated by a POSA, additional processing steps, such as patterning steps, would not normally be undertaken absent an express purpose or teaching; in particular, given that extra processing steps generally entail additional costs.

15[j/k]: a [first/second] driver circuit for [selectively supplying/supplying] said [address signal/image data] to said [address lines in sequence/data lines]; and

177. As I discussed above, in my opinion, a POSA would understand that the first and second driver circuits of claim 15 would be necessary for the device in Utsugi to function as intended. Both passive and active matrices require such circuitry to cycle through the address lines and provide data along the data lines. However, to the extent there is any question, a POSA would have been motivated to include such circuitry to select the various rows of the display matrix and to provide image data on the various data lines. Such circuitry would have been well-known to a POSA at the time of the alleged invention of the ’450 patent, and implementing such circuitry would have been well within the skill of a POSA.

178. As noted by the examiner, contemporary references such as U.S. Patent No. 5,847,516 (Ex. 1011, "Kishita") would have been available to a POSA, and would have taught a POSA the need for driver circuitry. Ex. 1002 at 160 (August 31, 1999 Non-Final Rejection). As I explained earlier, the claim does not require any particular circuitry. Accordingly, a POSA would have been able to implement any of a number of known circuits that would implement the described functionality.

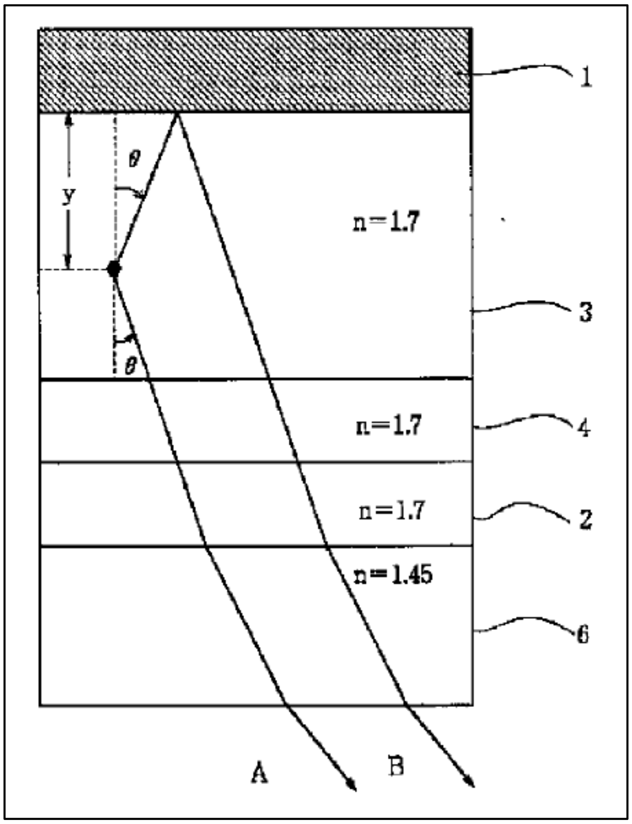
179. Accordingly, even assuming that Utsugi does not disclose this limitation, a POSA would have been motivated to modify Utsugi in a way that satisfies this limitation, and would have reasonably expected success in doing so.

XI. THE COMBINATION OF UTSUGI AND MANABE (CLAIM 3)

180. Manabe addresses a problem associated with the viewing angles of organic electroluminescent displays. A display's viewing angle is the angle at which the display can be viewed with acceptable visual performance.

181. As Manabe explains, in displays having a reflective electrode, like the first electrode (electron injection electrode 55) of Utsugi, problems can occur such that the luminance "changes with viewing angle" due to the reflection of light from the organic electroluminescent layer. Ex. 1004 at ¶ 20. As shown in Figure 5 below, the decrease in luminance is due to the emission from the EL layer taking two different paths—one path directly to the viewer, labeled as path "A," and a second

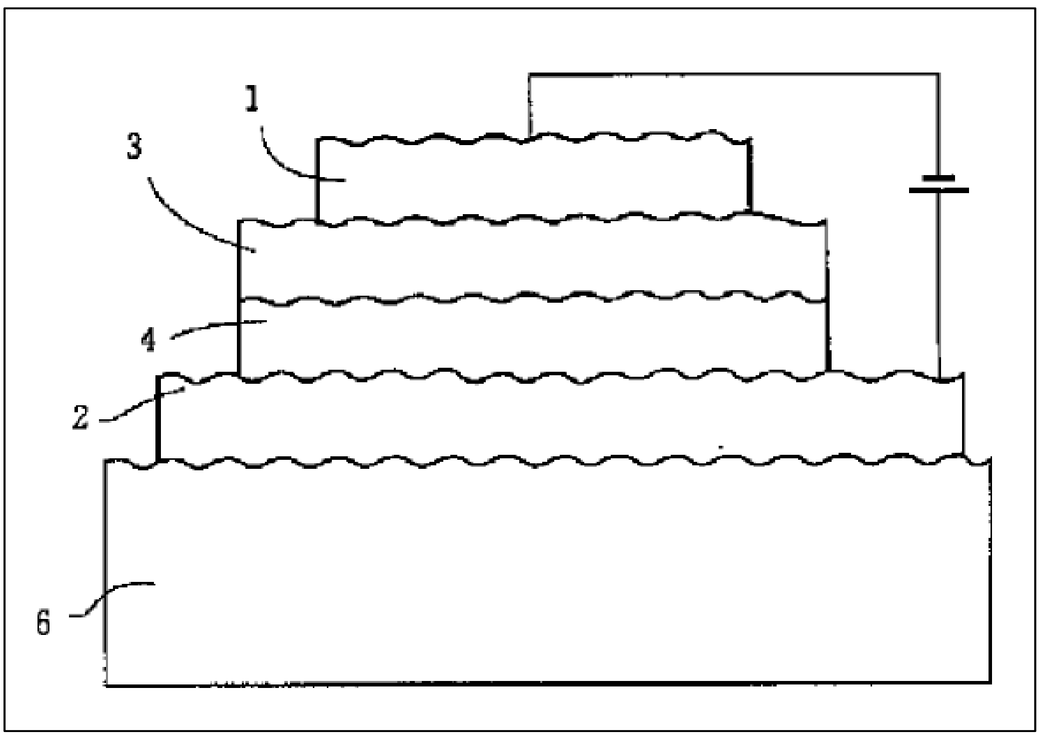
path that is reflected off of the metal electrode before reaching the viewer, labeled as path "B."



182. The effect of these multiple paths is that a viewer looking at a screen from one angle may see a different luminance level than a viewer looking at a screen from a second angle. In practice, this may mean that a viewer will have to sit in a particular location to perceive an optimal display, or that multiple viewers sitting at different angles may have different display experiences.

183. Manabe addresses this problem, and thereby improves the display quality, by creating a roughened surface between at least the reflective metal electrode 1 and the organic EL layer 3, as shown in Fig. 1 below. Ex. 1004 at ¶ 24.

Manabe teaches that "roughening of the surface . . . of the metal electrode in contact with the organic EL layer [i.e., the cathode] causes slight differences in the light path from light sources within the light emission layer causing averaging of the interference effect and reducing angle dependence and film thickness dependence." Ex. 1004 at ¶ 24; *see also* Ex. 1004 at ¶ 34 (explaining that the "interference effect is averaged and angle dependence and membrane thickness dependence is reduced by roughening . . . the surface in contact with the organic EL layer of the metal electrode to cause differences in optical path variations from light emitting points inside the light emitting layer.").



184. In my opinion, a POSA would have been motivated to modify Utsugi to obtain a roughened electrode as in Manabe, to arrive at what is claimed in the '450

patent, and to gain the benefits of Manabe's design, i.e. to obtain the known improvements in viewing angle of an organic EL display. Further, it would have been straightforward for a POSA to modify Utsugi in the manner described by Manabe, i.e., to roughen the surface of the first electrode (electron injection electrode 55) of Utsugi, and a POSA would have readily expected success in and predictable results from making these modification.

185. First, as noted above, Utsugi and Manabe both come from the same field of endeavor, the design of organic electroluminescent displays. Ex. 1003 at 3:66–4:4, 4:28–33; Ex. 1004 at Title. Second, Utsugi and Manabe have very similar electroluminescent element structures, comprising a transparent anode electrode, an organic electroluminescent layer, and a reflective cathode. *See* Ex. 1003 at Fig. 5; Ex. 1004 at ¶ 26. In particular, Manabe describes the use of an MgAl metal electrode (cathode). Ex. 1004 at ¶ 26. A POSA would appreciate that an MgAl electrode would have similar relevant properties to the MgAg and Mg first electrodes (electron injection electrodes 55) described by Utsugi. Ex. 1003 at 9:9–13. Third, a POSA would have been aware of a number of potential methods for roughening the MgAg surface, including various deposition techniques, chemical etching techniques, as well as abrasive techniques, similar to the fluorate and sandblast treatment set forth by Manabe for use with the glass substrate. Ex. 1004 at ¶ 28.

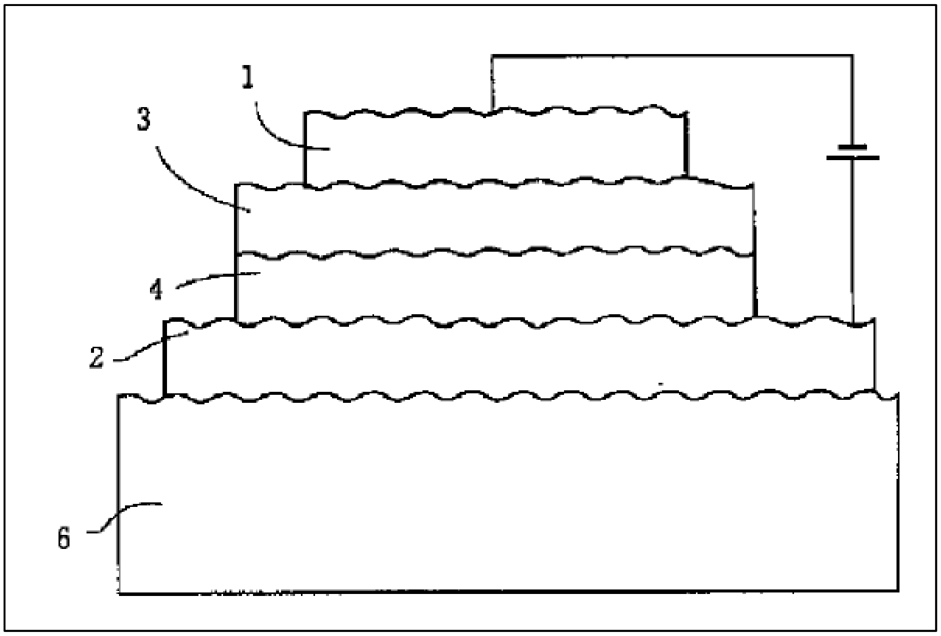
186. Consistent with my opinion, during prosecution, the Examiner found that "first electrode having a rough surface which is in contact with the electroluminescent layer is an [*sic*] design/manufacturing choice," and that "[i]t would have been obvious to a person of ordinary skill in the art at the time of the invention that specifying an electrode having a rough surface to be in contact with the electroluminescent layer is in common practice and well known in the art." Ex. 1002 at 159 (August 31, 1999 Non-Final Rejection). In fact, the Examiner did not even see a need to cite an additional reference for this proposition. In their response, the applicants did not dispute the Examiner's finding.

a. Dependent Claim 3

"The display apparatus according to claim 1, wherein said at least one first electrode has a rough surface which is in contact with said organic electroluminescent layer."

187. Manabe discloses the additional requirements of this dependent claim. That is, Manabe discloses a first electrode that has a rough surface which is in contact with an organic electroluminescent layer.

188. As previously described, and as shown in Figure 1 of Manabe below, Manabe discloses a metal electrode 1 with a roughened surface in contact with the organic EL layer 3.



189. Manabe teaches that "roughening of the surface of the organic EL layer in contact with the metal electrode or the surface of the metal electrode in contact with the organic EL layer causes slight differences in the light path from light sources within the light emission layer causing averaging of the interference effect and reducing angle dependence and film thickness dependence." Ex. 1004 at ¶ 24; *see also* Ex. 1004 at ¶ 34 (explaining that the "interference effect is averaged and angle dependence and membrane thickness dependence is reduced by roughening . . . the surface in contact with the organic EL layer of the metal electrode to cause differences in optical path variations from light emitting points inside the light emitting layer.").

190. Thus, modifying Utsugi to obtain a roughened electrode, as in Manabe, would lead to a device that satisfies dependent claim 3.

XII. THE COMBINATION OF UTSUGI AND EIDA (CLAIMS 9, 11–13, and 17–18)

191. Utsugi explains that, prior to the alleged invention of the ’450 patent, organic electroluminescent displays were “attracting attention[] for the possibility of realizing an inexpensive full-colored wide display that would be difficult using an inorganic thin-film EL element or an LED.” Ex. 1003 at 1:17–23. Utsugi describes an active matrix structure that can be used to drive pixels of an organic electroluminescent display. However, Utsugi does not go on to discuss the further steps of using the structure described in Utsugi for a multi-color or full-color display. On the other hand, Eida discloses how to use an organic electroluminescent device in conjunction with both color conversion layers (fluorescent layers) and color filters to achieve a multi-color display, as identified by Utsugi. In this case, a POSA would have looked to the disclosures of these references together when designing a multi-color, organic electroluminescent active matrix display.

192. As described more fully below, a POSA would have been motivated to combine the features of Utsugi and Eida to arrive at what is claimed in the ’450 patent—in particular, claims 9, 11–13, and 17–18—based on the disclosures in these prior art references, along with a POSA’s knowledge of the art at the time of the alleged invention of the ’450 patent.

193. Eida teaches multiple techniques for achieving a multi-color display using many of the same materials as Utsugi. In particular, Eida’s first invention

teaches a top-emitting, organic electroluminescent device, similar to the top-emitting organic electroluminescent device of Utsugi. Eida explains that it was well-known prior to the alleged invention of the ’450 patent that multi-color displays could be created using a number of different methods, including filtering white light into its primary color components, Ex. 1005 at 1:18–22, or using color conversion layers to convert light to different wavelengths corresponding to red, green, and blue light. Ex. 1005 at 2:30–3:6.

194. Eida teaches that when using the first method, i.e., filtering white light into its primary color components, “there is the problem that the light emission efficiency for each color is limited to 33% of the white light at most if the white color is decomposed by the color filter of three primary colors.” Ex. 1005 at 1:22–25. Eida discloses that it was well-known that this problem could be solved using color conversion layers, alone or in conjunction with color filters. “The installation of the fluorescent layer has the advantage that multi-color emission which is higher in efficiency than in the case of installing a color filter can be anticipated.” Ex. 1005 at 3:8–9. Assuming an 80% absorption efficiency of the color conversion layer and a 80% fluorescence efficiency, “64% of the organic EL element blue light [can] be[] converted to long wavelength visible light.” Ex. 1005 at 3:13–15.

195. Eida discloses with respect to its inventions that, in addition to using fluorescent color conversion layers to increase the efficiency of the colors being

emitted, color filers can also be used to "to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:15–16. The benefit identified by Eida, i.e., increasing color purity, is the same rationale for using color filters discussed by the '450 patent. Ex. 1001 at 13:11–18.

196. It would have been straightforward for a POSA to modify Utsugi in the manner described by Eida, i.e., to add fluorescent color conversion layers and color filters above the light emitting structure described in Utsugi, and a POSA would have readily expected success in and predictable results from making these modifications.

197. First, as noted above, Utsugi and Eida both come from the same field of endeavor, the design of organic electroluminescent displays. Ex. 1003 at 3:66–4:4, 4:28–33, Ex. 1005 at 1:5–8, 5:17–16. Second, Utsugi and Eida disclose electroluminescent elements having the same basic structure, i.e., Utsugi and the first invention of Eida disclose top-emitting, organic electroluminescent displays. *See* Ex. 1003 at Fig. 5; Ex. 1005 at Fig. 5. Third, Eida explains that, even prior to the inventions disclosed in Eida, the use of color conversion layers and color filters were well-known to a POSA and widely implemented. Ex. 1005 at 1:18–3:27. Indeed, Eida teaches that the color filters can be formed "by performing prescribed patterning on prescribed positions of a material selected from known materials, by photolithography method or printing method." Ex. 1005 at 36:7–9.

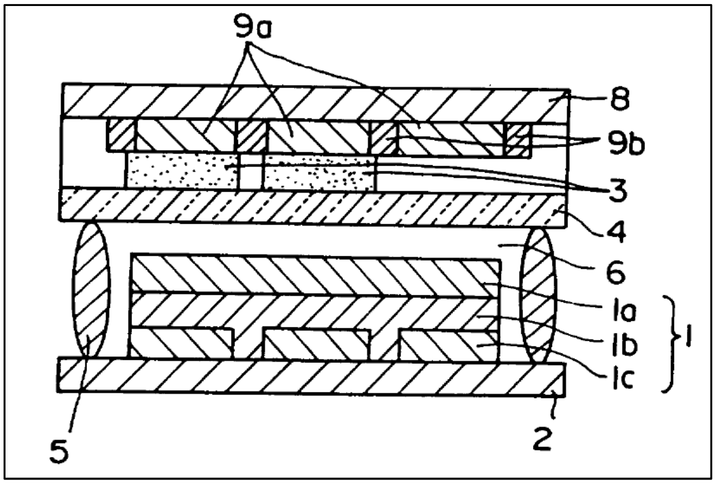
198. To solve the additional problems identified by Eida, a POSA could have followed the teachings of Eida, and implemented an additional substrate to support the color conversion layers and color filters, as described by the first invention of Eida, or a POSA could have implemented alternative manufacturing techniques, such as the inorganic oxide layer, adhesive layer, and fluorescent protective layer, as described in the second invention of Eida. All of these manufacturing methods would have been well within the skill of a POSA, in particular, given the teachings set forth in Eida.

a. Dependent Claim 9

The display apparatus according to claim 1, further comprising at least one wavelength conversion layer formed over said at least one second electrode, said at least one wavelength conversion layer emitting light in a first wavelength range by absorbing light in a second wavelength range emitted from said organic electroluminescent layer.

199. Eida discloses the additional requirements of this dependent claim. That is, Eida discloses a display apparatus comprising at least one wavelength conversion layer formed over the first electrode of the organic EL structure, the purpose of the conversion layer being to absorb light in one wavelength range and emit light in a second wavelength range.

200. Specifically, as shown in Figure 5 below, Eida's first invention discloses a top-emitting organic electroluminescent device.



201. A fluorescent layer 3 is formed above the EL structure, defined by a first electrode (transparent electrode 1a), an organic EL layer (organic compound layer 1b), and a second electrode (electrode 1c). Eida teaches that fluorescent layer 3 "convert[s] the light emitted from an organic EL element into light of a wave length longer than that of the light emitted from the organic EL element." Ex. 1005 at 9:24–26.

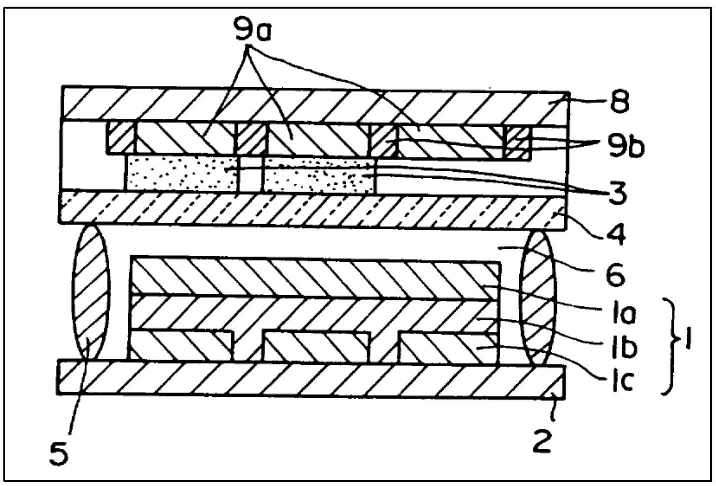
202. Thus, modifying Utsugi to comprise at least one wavelength conversion layer, as in Eida, would lead to a device that satisfies dependent claim 9.

b. Dependent Claim 11

The display apparatus according to claim 9, wherein said at least one wavelength conversion layer has at least two of a red conversion layer which emits light in a red wavelength range, a green conversion layer which emits light in a green wavelength range, and a blue conversion layer which emits blue light.

203. Eida teaches or suggests the additional requirements of this dependent claim. That is, Eida teaches or suggests the use of a wavelength conversion layer having at least two of red, green, and blue conversion layers.

204. As illustrated in Figure 5 of Eida, Eida teaches that its first invention includes a fluorescent layer 3. As previously discussed, the purpose of fluorescent layer 3 is to "convert the light emitted from an organic EL element into light of a wave length longer than that of the light emitted from the organic EL element." Ex. 1005 at 9:24–26.



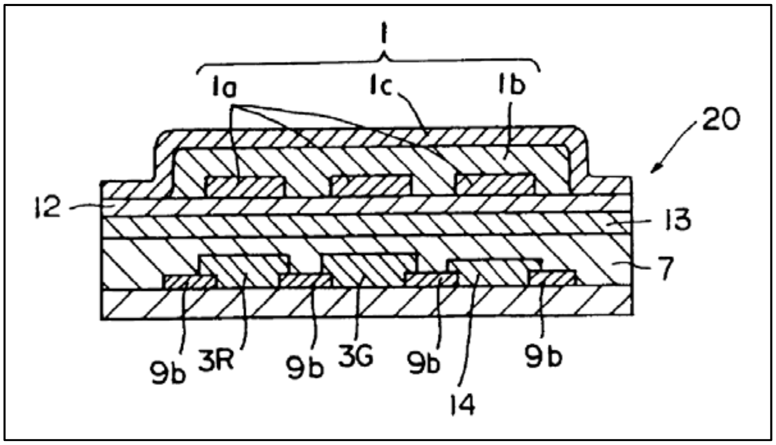
205. As shown in Figure 5 above, fluorescent layer 3 includes two components. While these two components are not explicitly labeled in Figure 5, a POSA would understand that the purpose of these two components is to convert the light emitted from the organic EL element into two different colors, specifically red and green, i.e., that one would be a red conversion layer and the other would be a green conversion layer.

206. As Eida teaches, the fluorescent layers 3 "emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)," Ex. 1005 at 10:11–13, as would be necessary for a multi-color display. A POSA would understand that to emit all three primary colors, the device shown in Figure 5 would emit blue light from the organic EL element, and would convert a portion of that blue light to both red and green light. The combination of the three would allow for a multi-color display.

207. In fact, Eida teaches that while "it is preferable to use organic EL elements that emit light ranging from near ultraviolet light to light of a green color, more preferably a blue-green color [is used]." Ex. 1005 at 10:26–28. This is consistent with the fact that blue light emitting layers have long been commonly used for multi-color displays, well before the filing of the '450 patent. Eida provides a number of "organic compounds used for producing emitted light of a blue color to a blue-green color," Ex. 1005 at 17:1–4, as well as examples of "fluorescent coloring material converting blue or blue-green light emission to green light emission," Ex. 1005 at 30:17–24, and "fluorescent coloring material converting blue or green light emission to orange and to red emission." Ex. 1005 at 30:26–32.

208. Notably, Eida's second invention shown in Figure 13 below explicitly labels the fluorescent layer 3 as "3G" and "3R," representing the green and red color conversion layers, respectively. Eida teaches that the "[m]aterials used for the

fluorescent layer [in the second invention] can be the same materials as those used in the first invention." Ex. 1005 at 40:25–26. Accordingly, a POSA would understand the teachings of the second invention of Eida with respect to the color fluorescent layer 3 to be equally applicable to the first invention.



209. Thus, modifying Utsugi to comprise at least one wavelength conversion layer having at least two of a red, green, and blue conversion layer, as in Eida, would lead to a device that satisfies dependent claim 11.

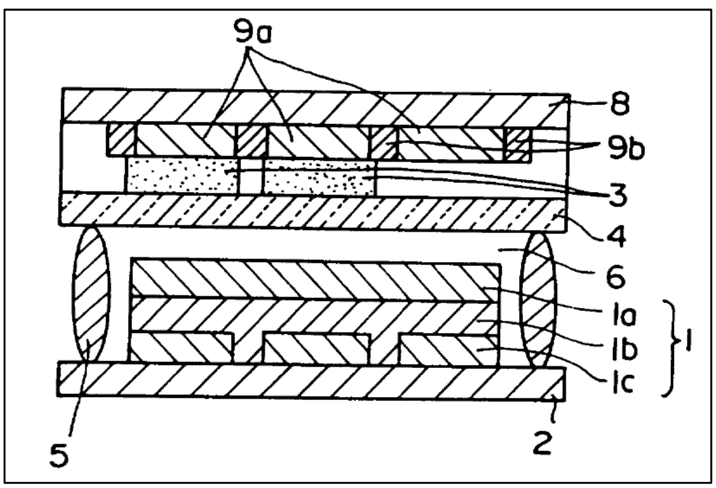
c. Dependent Claim 12

The display apparatus according to claim 1, wherein: said display apparatus further comprises at least one filter formed above said at least one second electrode; and light [r]ays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

210. Eida discloses the additional requirements of this dependent claim. That is, Eida discloses the use of a color filter formed above the organic

electroluminescent device, wherein rays in a first wavelength range pass through the filter selectively, when rays in a second wavelength range enter the filter.

211. As illustrated in Figure 5 of Eida below, Eida teaches that "a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:15–16. A POSA would appreciate that the claimed function, i.e., that "light [r]ays in a first wavelength range pass through said at least one filter selectively when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter," is nothing more than the conventional and well-known function of a color filter.



212. Thus, modifying Utsugi to comprise at least one filter, as in Eida, would lead to a device that satisfies dependent claim 12.

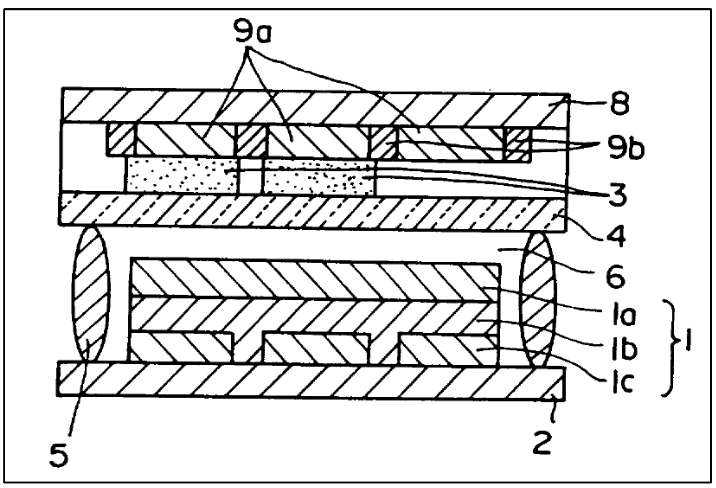
d. Dependent Claim 13

The display apparatus according to claim 12, wherein said at least one filter has a red filter which makes light in a red wavelength

range pass through, a green filter which makes light in a green wavelength range pass through, and a blue filter which makes light in a blue wavelength range pass through.

213. Eida teaches or suggests the additional requirements of this dependent claim. That is, Eida teaches or suggests the use of three separate filters, a red filter which makes light in a red wavelength range pass through, a green filter which makes light in a green wavelength pass through, and a blue filter which makes light in a blue wavelength range pass through.

214. As illustrated in Figure 5 below, Eida teaches that its first invention includes three separate color filters labeled as 9a. "[C]olor filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:15–16.



215. As discussed above with respect to claim 11, a POSA would appreciate that the purpose of the first invention of Eida is to emit all three primary colors for a multi-color display. Indeed, Eida teaches that the fluorescent layers 3 "emit rays

of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)." Ex. 1005 at 10:11–13. As previously noted, this would entail forming both red and green conversion layers in the fluorescent layer 3.

216. A POSA would understand that to promote the color purity of each color—red, green, and blue—red and green filters would be arranged on top of their respective fluorescent layers, and a blue filter would be used to filter the blue light coming directly from the organic compound layer. Indeed, with respect to the second invention, Eida explicitly notes that "a red color filter and a green color filter may be arranged between the red color conversion fluorescent layer 3R and the transparent substrate, and between the green color conversion fluorescent layer 3G and the transparent substrate respectively," Ex. 1005 at 38:4–8, and "[a] blue color filter 14 may be disposed in parallel with the red color conversion fluorescent layer 3R and the green color conversion fluorescent layer 3G, thereby adjusting the colors of light emitted from the organic EL element to improve the purity of these colors," Ex. 1005 at 38:10–12. A POSA would understand that the concept of using color filters in conjunction with color conversion layers as described in the second invention of Eida is equally applicable to Eida's first invention.

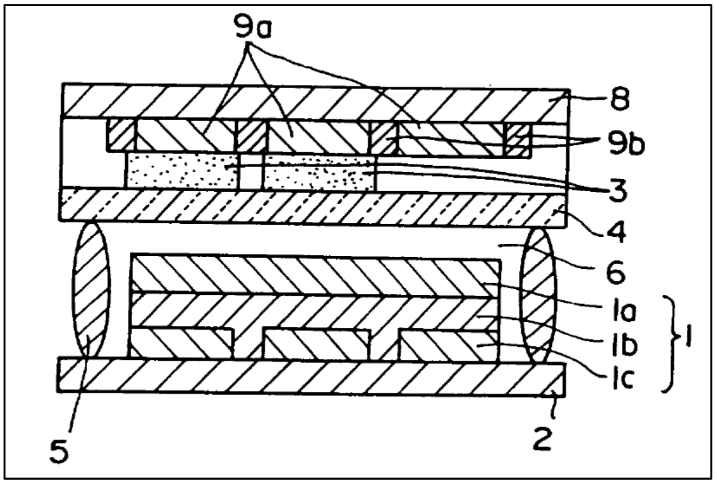
217. Thus, modifying Utsugi to comprise at least one filter with a red, green, and blue filter, as in Eida, would lead to a device that satisfies dependent claim 12.

e. Dependent Claim 17

The display apparatus according to claim 1, wherein said display apparatus further comprises at least one filter, formed above said at least one second electrode, which selectively permits light rays in a first wavelength range to pass therethrough when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter.

218. Notably, claim 17 appears to be nearly identical to claim 12. Accordingly, for the same reasons as discussed above with respect to claim 12, Eida discloses the additional requirements of this dependent claim 17.

219. As illustrated in Figure 5 of Eida below, Eida teaches that "a color filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:15–16. A POSA would appreciate that the claimed function, i.e., that "selectively permit[ing] light rays in a first wavelength range to pass therethrough when incident light rays in a second wavelength range including said first wavelength range enter said at least one filter," is nothing more than the conventional and well-known function of a color filter.



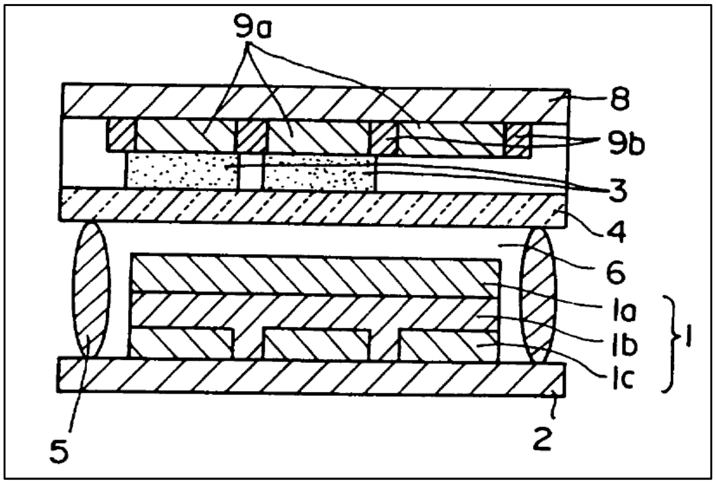
220. Thus, modifying Utsugi to comprise at least one filter, as in Eida, would lead to a device that satisfies dependent claim 17.

f. Dependent Claim 18

The display apparatus according to claim 17, wherein said at least one filter has a red filter which permits light in a red wavelength range to pass therethrough, a green filter which permits light in a green wavelength range to pass therethrough, and a blue filter which permits light in a blue wavelength range to pass therethrough.

221. Notably, claim 18 appears to be nearly identical to claim 13. Accordingly, for the same reasons as discussed above with respect to claim 13, Eida teaches or suggests the additional requirements of this dependent claim 18.

222. As illustrated in Figure 5 below, Eida teaches that its first invention includes three separate color filters labeled as 9a. "[C]olor filter 9a may be arranged on each of the fluorescent layers 3 to control the fluorescent colors and thereby to promote the color purity." Ex. 1005 at 10:15–16.



223. As discussed above with respect to claim 11, a POSA would appreciate that the purpose of the first invention of Eida is to emit all three primary colors for a multi-color display. Indeed, Eida teaches that the fluorescent layers 3 "emit rays of fluorescent light of different colors . . . to obtain emitted light of the three primary colors (RGB)." Ex. 1005 at 10:11–13. As previously noted, this would entail forming both red and green conversion layers in the fluorescent layer 3.

224. A POSA would understand that to promote the color purity of each color—red, green, and blue—red and green filters would be arranged on top of their respective fluorescent layers, and a blue filter would be used to filter the blue light coming directly from the organic compound layer. Indeed, with respect to the second invention, Eida explicitly notes that "a red color filter and a green color filter may be arranged between the red color conversion fluorescent layer 3R and the transparent substrate, and between the green color conversion fluorescent layer 3G and the transparent substrate respectively," Ex. 1005 at 38:4–8, and "[a] blue color

filter 14 may be disposed in parallel with the red color conversion fluorescent layer 3R and the green color conversion fluorescent layer 3G, thereby adjusting the colors of light emitted from the organic EL element to improve the purity of these colors," Ex. 1005 at 38:10–12. A POSA would understand that the concept of using color filters in conjunction with color conversion layers as described in the second invention of Eida is equally applicable to Eida's first invention.

225. Thus, modifying Utsugi to comprise at least one filter with a red, green, and blue filter, as in Eida, would lead to a device that satisfies dependent claim 18.

* * *

226. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

November 7, 2019
Date

Adam Fontecchio, Ph.D.